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ELEMENTS

OF

MATERIA MEDICA

AND

THERAPEUTICS;

INCLUDING

THE RECENT DISCOVERIES AND ANALYSES OF MEDICINES.

BY

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PART III.

SECTION VIII.

ASTRINGENTS:—MEDICAMENTA ASTRINGENTIA*.

ASTRINGENTS are substances which produce contraction and condensation of the muscular tissue. To understand this definition, we must know what is meant by muscular tissue and its properties. As far as the unaided power of the eye can guide us, the muscular tissue appears to consist of bundles of fibres, which are flattish, linear, soft, white in some animals and red in others, plaited in their length, and composed almost exclusively of fibrine. But, when the microscope is called in to aid our limited vision, we find that the fibres, of which these bundles are composed, are themselves bundles of smaller fibres, enclosed in thin membranous expansions. If we trace the nature of these fibres from the writings of microscopic observers, we find the most opposite descriptions. Muys and Lewenhoeck maintained that each fibre is composed of still smaller fibrils, in the proportion, says Muys, of 900 in the thickness of the finest hair; but, according to Lewenhoeck, of 3180, as he assures us that he counted that number in the muscular fibre of a fish. On the contrary, Prochaska avers, in the most positive manner, that the size of the ultimate fibril is about the $\frac{1}{50}$th part only of the diameter of the red globule of the blood. Later investigations even extend this magnitude: the observations of Sir E. Home and Mr. Bauer make the ultimate filament to consist of a series of globules, exactly corresponding in size

* Derived from *astringere*, to contract.

with the uncoloured globules of the blood, connected by an elastic medium, by means of which a visible interval may be produced between the globules; but this globular structure is denied by Dr. Hodgkins, who regards it as truly fibrous. Mr. Hare affirms that each fibre consists of minute tubes, $\frac{1}{100}$th of an inch in diameter, and exhibiting longitudinal striæ with transverse bands. Mascagni describes it to be a small cylinder filled with glutinous matter, whilst Meckel and Rudolphi believe that it is solid. It would be out of place here to criticise these descriptions of the ultimate muscular fibre: the knowledge conveys no real information, and, in the language of Bichat, "is merely a concourse of vague ideas." Whatever may be the form and magnitude of this part of our structure, it is of more importance to know that it is connected with cellular tissue, exhalant and absorbent vessels, arteries, and veins, as well as nerves, both of sensation and of motion. The distribution of nerves to muscles is unequal, and the power of contraction appears to be nearly in the ratio of the number with which a muscle is supplied. The nervous trunks in entering a muscle run in the direction of the muscular fasiculi, giving out laterally twigs which divide and subdivide in the interstices, until they can no longer be traced, and appear as if absorbed or lost in the tissue of the fibrils. It was at one time believed that the nervous filaments deliquesce into an invisible pulp, and unite intimately with the muscular fibrils; but the later observations of MM. Prevost and Dumas have demonstrated the error of this opinion. According to these physiologists, the minute filaments of a nervous cord, entering a muscle, traverse the fibres at a right angle and at short distances from one another, and then either return to the same nerve or anastomose with some neighbouring branch of another. I am most anxious to solicit attention to this fact, as it applies directly to our enquiry. In some instances, as in the muscles of the face, there is a junction of sentient nerves with nerves of motion: yet this union does not appear to exist in all muscles. With regard to blood vessels, no organs in proportion to the extent of their volume or bulk are so amply supplied with blood. The arteries, given off from the neighbouring large

trunks, penetrate the substance of the muscle, then divide to supply the secondary bundles of fibres, and again and again subdivide, until they become capillaries attached to the fibrils. Such is the muscular tissue: therefore, under whatever form it appears, it is a compound substance; it possesses also compound functions, or, in other words, both physical and vital properties.

A muscle owes its physical properties, its cohesion, flexibility, and extensibility to the same causes as matter in general: its elasticity is also a physical property, or the property of shortening itself; but its contractility is solely dependent on vitality. In this contraction there is a real generation of power: it is distinct from any other power in nature, is peculiar to life, and is regulated by laws different from those of any other power: it does not cease immediately on the extinction of life, and indeed continues in some degree until putrefaction take place. But, although it be admitted that the power of contraction be inherent in the muscular fibre, it must, also, be admitted that we know of no means by which this power can be excited without the intervention of the nerves. If the muscle on the belly of a frog be so placed in a frame that the Galvanic fluid may be directed through it, the following phenomena become apparent under the microscope. When the stimulus is applied, the fibres shorten themselves, or rather the two extremities of the fibres are seen to approach one another, by the intermediate space bending at numerous angles into zig-zag lines; but when the stimulus is withdrawn, the fibres again regain their straight direction. Prevost and Dumas, who made this observation, in confirmation of what had been previously observed by Dr. Hales, assert that these angles are nearly at equal distances, and correspond with the intersection of the nervous filaments. Now, is this condition of the muscular fibre peculiar to it only when that power which may justly be denominated muscular is exerted? and is the state of the same fibre, whatever may be its condition as to tone, that of a straight fibre, when this power is dormant? To reply to this question satisfactorily, would require more powerful microscopes, and a greater perfection in using them than has been yet attained; I will,

therefore, assume it as a fact, that, whatever may be the linear direction of the ultimate muscular fibrils in their state of tone, or greatest density and cohesion, independent of that contraction which follows volition or the application of some external irritant, this state is intimately connected with and solely dependent on vitality. That this is actually the case is well demonstrated by the fact, that a muscle, which during life can sustain a certain weight, is torn asunder by the same weight after death, or after it is completely separated from the living body: the great tonicity or strength of muscles during life depends, therefore, on a cause different from that of simple cohesion, and exists only during the life of the part. But this state is not always the same during life. In certain conditions of the habit, the muscular fibres seem to lose in a great degree their cohesiveness and elasticity; and with these their contractility, or property of responding to the will and of contracting on the application of material excitants, is lessened; and the hollow muscles, in particular those surrounding the arteries, lose their power of resisting the pressure of the contained fluids, which either burst their coats or find their way through them, producing what is termed passive hæmorrhage. This loss of contractile power is also perceived in the abdominal muscles of women who have borne many children, and in the scrotum after the discharge of the fluid from an old hydrocele. It is to remove this condition of the muscular tissue that Astringents are indicated; and, keeping in view the nature of the parts on which their influence is exerted, let us examine in what manner their action is to be explained.

Most of the writers on Materia Medica have endeavoured to explain the influence of Astringents on the living body, by reasoning analogically from their influence in hardening and condensing dead animal matter. It is true that the substances which bestow toughness, solidity, and impermeability to the soft skin of a dead animal, so as to convert it into leather, operate as Astringents on the living muscular fibre.

Looking at this fact, were the enquiry to proceed no further, it is not surprising that erroneous inferences should be deduced from it in explaining the action of Astringents:

indeed the presence of life seems in some instances rather to favour than to resist the operation of Astringents. But, still the appearance of similar results, in states of the body so opposite as that of life and death, is not conclusive that the cause is the same in both cases. In further examining the question, therefore, let us first trace the causes of the effects which Astringents produce upon dead animal matter, and then examine whether the same circumstances occur in the living body, and endeavour to frame some satisfactory theory of the operation of Astringents as affecting the living solid.

The material agents which produce on dead animal matter that change of condition which is supposed to be the result of astringency, are *cold*, *alcohol*, *acids*, and *tannin*.

Cold, the first of these agents, is a negative quality, the absence of a positive principle *caloric*.

In admitting the substantive nature of caloric, this question arises, how does its absence operate in contracting and constringing dead animal matter? We know that caloric passes from bodies containing much of it into those which contain less, until both arrive at an equilibrium; and that the consequence of its accumulation in any body is the separation of the particles and a consequent reduction of the cohesion of that body. Now, if the presence of caloric weakens this force, the abstraction of it must necessarily increase it; the body is condensed, occupies smaller space, and proves more capable of resisting any force applied to separate its parts than when the caloric is present in it; or, in other words, the strength of the body is augmented by the abstraction of caloric. A thong of an untanned skin, which can support a weight of ten pounds in a temperature of 85°, will support an additional weight at a temperature of 40°: is this the case in the living solid? can the effect be explained on the same principles?

It is an undoubted fact that cold operates as an Astringent to the living animal solid. In warm weather, in the same climates, the muscles of the living animal are softer, less capable of powerful action, and more feeble in every respect than in cold weather; nevertheless, caloric acts as a stimulant to the living body; and as such it ought to augment the

strength of the muscles. To explain and reconcile these contrary facts, we must keep in view that law of the system by which the continued action of every stimulant is followed by collapse: that, when this occurs, the vitality of the part is so much lowered that the ordinary physical laws connected with the operation of caloric exert their influence on the body; and, consequently, the debility of a muscle in warm weather is due to the same cause which weakens the cohesive power of dead animal matter. Abstract caloric, therefore, from a living body, the first effect is of a physical kind; the parts of the living muscle are mechanically condensed; but it is the exertion of the living principle on the restored excitability of the part which renders this condensation permanent, and maintains its tonic power. Thence we may conclude that, as far as *cold* acts as an astringent, we cannot explain its operation as such by reference merely to its effects upon the dead animal matter.

With regard to the action of the second agent, if a piece of muscle of a dead animal be put into *alcohol*, it lessens its bulk and hardens it, and this is generally referred to the astringent property of the spirit; but chemistry informs us that alcohol has a strong affinity for water; that, in attracting it from the animal matter, the albumen is coagulated; and that, this contracting, the other solid components are more closely compacted with it, and the whole mass becomes smaller than it was before it was put into the alcohol. Now, does alcohol act in this manner on the living system? When applied to the surface of the body, alcohol operates as an excitant, but no coagulation of albumen results: if the quantity of alcohol be great, and its strength considerable, an immediate cessation of motion takes place in the capillaries; the globules of the blood stagnate, as it were, and become compacted in the vessels; the vitality of the part is either suspended or destroyed—a fact which is rendered obvious in the web of the foot of a frog examined under a powerful microscope. But if, on the other hand, inflammation previously exists in the vessels of the part, the application of diluted alcohol stimulates the coats of the inflamed vessels, contracts their diameters, by constringing their circular fibres, and thus

relieves the previously overloaded vessels. In this case, we can derive no aid in explaining the cause of the astringency of alcohol applied to the living body, by reference to its effects on dead animal matter.

Nearly the same reasoning may be applied to the action of *acids*, which, in a diluted state, act as Astringents, whether externally applied or taken into the stomach. These acids corrugate the dead animal fibre; and act chemically upon it, coagulating the albumen, and forming new compounds: on the living fibre they operate as excitants and tonics, increasing the general vigour of the frame and producing that state which is termed tone, in which the adhesive power of the parts is augmented without any change in their composition. Here, again, are two states of bodies as opposite as possible, produced by the action of the same substances: but certainly from very different impressions.

The last of the astringent substances referred to is *tannin*. Plants which contain it, when taken into the mouth, seem to draw the parts together; and by the extent of this sensation we judge of the degree of astringency of the plant. When applied to dead animal matter, they apparently act in the same manner, shortening the longitudinal length of muscular fibres, and diminishing the diameter of vessels. But, besides these effects, we find that a new substance is formed which did not previously exist: the tannin unites chemically with the gelatine of the dead animal matter, and forms a solid, insoluble compound, which resists the action of water and does not putrefy. Something of the same kind, it is true, is produced by the application of tannin to the living body: thus, if Catechu and other powerful Astringents of a similar description be mixed with newly drawn blood, whilst it is yet flowing from the vein of an animal, the blood is coagulated sooner and more firmly than when no Catechu is mixed with it; and, when the same substance, in solution in water, is injected into the veins in living dogs, the animals are killed, and the blood in the heart and large vessels is found firmly coagulated. We nevertheless cannot admit that vegetable Astringents operate in the same manner on living as on dead animal matter, obviating mechanical laxity by their coagulating

power; for, unless debility be a mere mechanical laxity of the muscles, we cannot admit that this state can be removed by the coagulating power of the astringents, as exerted on dead animal matter: to use the language of Dr. John Murray, "it is now admitted that every degree of strength or weakness depends much more on correspondent variations in the state of the powers peculiar to living matter; and substances capable of obviating disease dependent on any state of debility, must be such as are capable of acting upon these powers. Many substances accordingly, arranged as Astringents, occasion very considerable alterations in some of the functions: they produce effects which cannot be referred to their condensing power, allowing them to possess it; and, therefore, in all the changes they produce, part of their operation, at least, must be referred to actions which they exert, conformable to the laws of the living system." Upon the whole, we have no hesitation in concluding, that no satisfactory explanation of the action of Astringents in the living body can be founded on the analogy of their action on dead animal matter. Indeed, it may be affirmed, not only of Astringents, but of all medicines, that their operation does not depend on ordinary physical laws—those "of matter and motion which take place in inanimate bodies—but on a principle which subsists in living bodies only*." Thence we refer the action of Astringents to the laws of the living system; and it is evident that they operate chiefly as excitants: but, in stating this opinion, it is requisite to draw the distinction between Astringents, Excitants, and Tonics. *Excitants* act powerfully on the excitability of the part to which they are applied, producing sensation and a sudden contraction or motion; and extending their action over the whole habit: but this is followed by corresponding relaxation. *Astringents* operate, also, by causing sudden contraction: which is evidently different, not only in degree, but in kind, from that excited by general excitants. *Tonics*, whilst they promote contraction and density, differ from Astringents in so far that their action is slowly produced, and confined within that limit which may be regarded as the natural state of the healthy

* Cullen, Lectures on Mat. Med.

solid. Thus, the distinction between the three powers stimulus, tone, and astringency, is sufficiently obvious : if an astringent be applied to any part of the body on which the action induced admits of ocular demonstration — as, for example, the lips—the first effect produced is a contraction of the muscular fibres and of the blood-vessels of the part ; the lips become pale, and a sensation of dryness and roughness is felt on the palate, the effect of a real corrugation, which is owing to the action of the Astringent on the motor nerves of the parts exciting the contractility of the muscular fibres. But this action differs from that of an ordinary excitant, which rouses the contractility of the muscular fibre, less than its sensibility; whereas the Astringent acts on the former property only of the solid fibre, and a corrugation or new arrangement of the component fibrils—shortening, thickening, and condensation—are the consequence. We are conscious of this effect when it thus occurs in a sensible part; but the sensation appears to arise rather from the compression of the extremities of the sensitive nerves, by the condensation of the contracted fibres, than from any immediate impression of the astringent substance on the sensitive nerves. The sensation therefore induced is a secondary effect; the contraction being the primary, and resulting from the immediate impression of the Astringent on the minute extremities of the motor nerves.

In regarding Astringents as stimulants, it is necessary that we should understand the distinction between their operation and that of stimulants which affect, decidedly, the sensibility. When a general stimulant is applied to a sensitive part of the body, the impression is made on a set of nerves which seem to serve merely as media of communication between the brain and the parts affected; the mind, therefore, through the medium of the stimulated nerves and the brain, becomes conscious of the impression ; and the motion which follows is the consequence of that affection of the mind which we term volition, operating on the origin of the nerves of motion, supplying the impressed or stimulated part. It may be contended that contractions occur in muscular parts from the application of stimuli, independent of volition ; for a sharp instrument

run into a muscle will produce an immediate contraction. I admit the immediate effect of such an application ; and I must also admit that, when this occurs in a muscle separated from the body, the effect cannot be regarded as the result of volition : but I must contend that, in every instance accompanied with sensation, volition is more or less the power which calls the muscle into action. But, when an Astringent acts upon a part, no communication of this kind takes place, the nerves of motion are *immediately impressed*, and a movement in the fibres which they supply takes place.

If this view of the subject be correct, we may venture to explain the operation of Astringents by saying, that they *stimulate directly the ultimate fibrils of the motor nerves*, and, through them, produce an immediate effect upon the insensible contractility of the fibres which these nerves supply. It is not difficult to conceive that such an action, excited in a part, may be propagated by sympathy to other parts, or even to the whole system : thence, if any acerb fruit—a sloe, for instance—be chewed, a peculiar feeling, along with the corrugation, extending over the whole body, is induced. This extension of the action of Astringents may in some degree explain the benefit resulting from their employment in checking the inordinate secretions of distant organs : but it is more probable that they are taken into the circulation ; for, without such a supposition, we should not be able to explain the manner in which they act in stopping hæmorrhage when internally administered, especially when taken into the stomach. Mr. Brodie gave to a patient, who had a frightful hæmorrhage from the prostate gland, and in whom all other remedies had failed, a dose of Ruspini's styptic, and repeated the dose twice in the course of twelve hours. About half an hour after the first dose was taken, the bleeding ceased, and it never recurred.

From these premises, I venture to offer the following theory on the nature of Astringency. I conceive it to be a power which, through the medium of the motor nerves, acts on the *insensible* contractility of the muscular fibril, producing a closer approximation of their component particles ; and, by thus augmenting their cohesion, causing a greater and

more permanent density, and a corresponding vigour in the muscular tissue. This action differs from ordinary muscular contraction, in not being dependent on the nerves of sensation, and consequently in not being the result of any communication with the sensorium ; in not exhausting excitability ; and in the permanency of its effects. The movements constituting muscular contraction are the consequence of impressions conveyed to the brain, through the sensitive nerves, and thence to the motor nerves of the part : the contractions following the application of Astringents are the result of direct impressions on the motor nerves themselves, altogether unconnected with those of sensation. Let us now examine the manner in which this class of medicines operate upon the principal organs of the body.

1. *Action of Astringents upon the Digestive Organs.*—When a moderate Astringent is taken into the stomach, it acts upon the nerves of the organ, shortening the muscular fibres, not only of its tunics, but those of the blood vessels, lessening the capacity of the viscus, and giving density to its coats ; thence producing a tonic operation upon the moving fibres : but, if the Astringent be a powerful one, or the dose large, a painful sensation of constriction in the organ is experienced, and its local impression is felt over the whole internal system. The mucous membrane of the alimentary canal becomes comparatively dry, from the exhalations which usually moistens its surface being diminished; and, as this effect is felt through the whole of the intestines, costiveness is the result.

2.—*upon the Circulating and Respiratory Organs.*—When Astringents are taken into the circulation, which is the case with gallic acid in particular, the circular fibres of the arteries are shortened, the diameter of the vessels diminished, and the power, both of these and of the heart, augmented ; so that the pulse feels firmer and tenser ; but, nevertheless, the circulation is not accelerated ; or, in other words, a tonic effect is the result. It is to this general contraction of the vessels, and their increased density, that may be justly attributed the power of Astringents in hæmorrhages of internal organs, such as the bladder of urine and the kidneys, to which they cannot be directly applied. In relaxation of the mucous

membrane of the bronchial tubes, and a superabundant excretion of mucus into the cells, the influence of Astringents becomes strikingly obvious; and can only be explained on the supposition that the astringent is absorbed, and acts upon the muscular coats of these tubes and cells.

3.—*upon the Secerning System.*—From what has been said, it is evident that Astringents diminish, to a certain extent, the secretions; but most particularly the secretion of the kidneys. When the extreme vessels through which the urine filters into the papillæ of the kidneys are in a state of great relaxation in diabetes, there can be no doubt that any benefit derived from Astringents, in this state of the urinary organs, can only be referred to the direct application of the Astringent to the relaxed vessels. Astringents, indeed, it is well known, do not lessen the quantity of saccharine matter in diabetic urine, although they lessen the quantity of the urine.

4.—*upon the Nervous System.*—Little requires to be said upon this part of our subject; for, although it cannot be denied that the impression made by Astringents on the nerves of the stomach is communicated through the medium of the nerves to every part of the system, yet, this influence approaches more to that exerted by a tonic power than one purely astringent. It is no argument against the correctness of this opinion, that a few grains of acetate of lead, taken into the stomach, will restrain an internal hæmorrhage; for, in this instance, the influence of the salt of lead is probably to be ascribed rather to the diminished energy of the circulation which follows its administration than to any astringent property inherent in the preparation. Indeed, several substances usually regarded as Astringents, and undoubtedly capable of checking hæmorrhages, produce their effects in the manner just explained: by a sedative impression on the nervous system, diminishing the action of the circulating organs; and, consequently, affording opportunity for the formation of a clot at the bleeding orifice, by which the flow of the blood is checked.

All substances regarded as Astringents operate by one or other of the modes which have been described in the foregoing remarks: I have therefore founded upon them the

principal divisions of the table of Astringents. In the first division, I regard the substances arranged in it as exerting a *tonic power*, although I am satisfied that the power of *simple Astringents* and that of *simple tonics* differ, as I have already stated, in several respects; yet, as they may be substituted for tonics in diseases of debility, and some of them have the power of cutting short the paroxysms of ague, if given a short time antecedent to its accession, I have adopted the term *tonic* power, for want of a better. The second mode I have stated to be the exertion of a *sedative power*. On this subject I would add, that, although a sedative power is capable, as I have explained, of checking a hæmorrhage, by diminishing the impetus of the vascular system, yet, the substances placed under this head act primarily as local Astringents, by corrugating the extreme fibrils. To illustrate this by an example, let us suppose a *diarrhœa*, arising from acrid bile flowing into the duodenum. Now, an ordinary sedative administered under these circumstances would lessen the irritability of the intestines, and consequently render them less susceptible of the impression of the acrid matter; but a sedative Astringent would more certainly check the diarrhœa, by not only diminishing irritability, but, by its astringent influence, repressing the flow of the excretions of the canal itself, and also that of the acrid bile into it.

TABLE OF ASTRINGENTS.

A. ASTRINGENTS WHICH EXERT A TONIC INFLUENCE ON THE SYSTEM.

* *Organic Products.*

a. TANNIN—

combined with Gallic Acid, in

Roots of	Krameria *triandria*	4.	1.	Polygaleæ.
	Rumex *aquaticus*	6.	3.	Polygoneæ.
	Polygonum *bistorta*	8.	3.	———
	Geum *Urbanum*	12.	5.	Rosaceæ.
	Tormentilla *erecta*	12.	5.	———

Plant	Lythrum *Salicaria*	11.	1.	Salicareæ.
	Boletus *Ignarius*	24.	13.	Fungi.
Bark	Quercus *pedunculata*	21.	7.	Cupuliferæ.
Leaves	Arbutus Uva Ursi	10.	1.	Ericineæ.
Flowers	Rosa *Gallica*	12.	5.	Rosacaæ.
Fruit	Prunus *spinosa*	12.	1.	Amygdaleæ.
	Punica *Granatum*	12.	1.	Myrtaceæ.
Secretions	Pterocarpus *erinaceus*	17.	1.	Leguminosæ.
	Eucalyptus *resinifera*			Myrtaceæ.
	Catechu.			
	Galls.			

b. HEMATINE. Hæmatoxylon Campechian: 10. 1. Leguminosæ.

** *Inorganic Products.*

c. ACIDS—

Sulphuric Acid.
Acetic Acid.

d. METALLIC SALTS—

Alum.
Sulphate of Iron.
Muriate of Iron.
Sulphate of Copper.
Sulphate of Zinc.
Acetate of Zinc.
Nitrate of Silver.

B. ASTRINGENTS WHICH EXERT A SEDATIVE INFLUENCE.

e. METALLIC SALTS—

Carbonate of Lead.
Acetate of Lead.
Subacetate of Lead.

f. COLD—

Cold Water.
Evaporating Lotions.

C. SUBSTANCES OPERATING CHEMICALLY AS ASTRINGENTS.

g. CARBONATE OF LIME.

A. ASTRINGENTS WHICH EXERT A TONIC INFLUENCE ON THE SYSTEM.

* *Organic Products.*

a. TANNIN.

The peculiar nature of Tannin was first pointed out by the French chemist Deyeux. It received its name from the circumstance of its forming the principal agent in the operation of converting the skins of animals into leather; a process in which this principle, as obtained from oak bark and other astringent vegetables, is precipitated upon the glue or gelatin of the skins from water in which it is held in solution, and in which the skins, properly prepared, are placed. By the union of the gelatin of the skins with Tannin, the skins are rendered impermeable to water, and incapable of undergoing the putrefactive process, under the ordinary circumstances which favour that process, in untanned animal matters. This process is termed *Tanning;* thence, the French chemists named the principle on which the effect of it depends, *Tannin.*

Tannin, when pure and separated from the other substances with which it is combined in vegetables, is nearly colourless: the brown colour, described by chemical authors, being produced by the action of air, is brittle and breaks with a resinous fracture; it is unalterable in the air, and is easily pulverized. It is inodorous; its taste is astringent. Although not deliquescent, yet it dissolves readily in water; but is insoluble in strong alcohol, unless aided by heat, although alcohol moderately diluted dissolves it. Oxygen and chlorine change it into extractive devoid of astringency. Protosulphate of iron produces no change on pure Tannin; but the persulphate immediately precipitates it, in combination with the oxide, of a deep or greyish green colour: the persulphate is thus changed into a *Tannate of Iron;* but if an excess of the solution be added, what remains undecomposed of the persulphate is converted into the protosulphate, owing to the Tannin attracting the oxygen. The most striking pro-

perty of Tannin is the formation of an insoluble compound when it combines with gelatin. The precipitate is a compound of—

Gelatin	54
Tannin	46
	100

and is known under the name of *Tanno-Gelatine.* It affords a pretty accurate test of the quantity of Tannin contained in any astringent vegetable infusion or decoction. The concentrated solution of gelatin, therefore, is the test of the presence of Tannin in vegetable infusions or decoctions. If an excess of the solution of gelatin be added to the vegetable infusion from which the Tannin is to be separated, the precipitate is redissolved by the solution of gelatin. Lime water and barytic water precipitate Tannin from its solution, the precipitate being a compound of the earth and the Tannin. When the earth is separated by an acid, the freed Tannin again acts upon gelatin. From the analysis of Berzelius, the constituents of Tannin appear to be—

Hydrogen	4.186
Carbon	51.160
Oxygen	44.654
	100.000

But Tannin has been rarely procured in a state of purity. It is found chiefly in the inner bark of the roots and the stem of trees; sometimes it is contained in the wood, occasionally in the petals of the flowers, varying in character in different plants, owing to its combination with other principles. It has been employed, in its pure state, in uterine hæmorrhages; and M. Cavalier says it has succeeded in stopping these when many other astringents have failed. He gives it in doses of two grains every two hours. For this purpose it can be procured sufficiently pure from a solution of Catechu in cold distilled water, filtered and evaporated to dryness. Tannin, as it exists in plants, is generally combined with gallic acid.

Gallic acid is a crystallizable acid, procured in transparent octohedrons. It was first obtained by Scheele, who

published his method of procuring it in 1786. Its taste is acid, sweetish, and astringent. It is inodorous at the ordinary temperature of the atmosphere, but has an unpleasant, peculiar odour when heated. It is soluble in three parts of boiling and twenty-four parts of cold water. Alcohol dissolves one fourth of its weight. Ether also dissolves it. Its aqueous solution undergoes rapid decomposition when heated, and also spontaneous decomposition, becoming mouldy when it is exposed to the air. It sublimes by heat; and is converted into pyro-gallic acid. This acid is whiter than gallic acid, has a slightly bitter taste, and is soluble in 1½ parts of water at 56° Faht. and in ether. The aqueous solution reduces the persulphate of iron to the protosulphate, and reduces instantly nitrate of silver and of mercury to the metallic state.

Gallic acid forms soluble gallates with the alkalies. With barytic water and lime water it forms bluish-red flaky precipitates. It strikes a blue black with all the salts of iron.

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It is composed, according to the analysis of Berzelius, of—

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* *Roots.*

KRAMERIÆ TRIANDRIÆ RADIX. *Ratanhy Root.** L. D.—The Krameria *triandria* is a plant belonging to the natural order Polygaleæ†. It is a native of Peru, growing in arid and sandy places in several of the Provinces; but most abundantly near the city of Huanuco. Another species of the same genus, Krameria *Ixina*, a native of the Antilles, furnishes roots very similar in their appearances to those

* The name *Ratanhia*, in Huanuco, signifies "spreading:" in some provinces the plant is called *Mapato*, villous or tomentose, the young shoots being white and silky; in other places it is called *Pumacuchu*.

† Woodville's Med. Bot. 3rd edition, vol. v, p. 129. London Dispensatory, art. Krameria.

of K. *triandria**. The root is the part of the plant medicinally employed. It is in pieces of various thickness, of a dark red colour, breaking short, and exhibiting in the fracture a woody centre, and an easily separated, fibrous bark, which contains the active part of the root, the woody part being completely inert. On this account, in chusing Ratanhy root, the small roots are to be preferred, as in these the bark is comparatively thicker than in the larger roots.

The bark of Ratanhy root has a bitter, astringent taste, at first nauseous, but afterwards sweetish. The odour is earthy, and this is also the case with the decoction, which smells not unlike a raw potatoe. The bruised root, when infused in boiling water, yields a reddish-brown infusion, which is deepened by the pure alkalies; but no precipitate is thrown down. With the proto-sulphate of iron a greenish, and with persulphate a deep green, precipitate is formed; isinglass solution, a dirty white; lime water, a pinkish precipitate.

These reagents demonstrate that Ratanhy root owes its astringency to tannin without gallic acid. Alcohol digested on it takes up the colouring matter of the root, and part of its tannin; and also detects the presence of resin, which is slowly separated when the tincture is poured into water. According to Vogel, the constituents of 100 parts of this root are—40 of a peculiar principle, which he names modified tannin; 1.50 of mucilage; 0.50 of fecula; 48.00 of fibrine; and 10.00 of water and loss: but this analysis is not to be depended on, as it mentions neither resin nor pure tannin, both of which are certainly constituents of Ratanhy root. M. Peschier of Geneva has also stated that he has detected a peculiar acid in this root, which he names the Krameric; but, as it has not been found by others, its existence is doubtful†.

As an Astringent, the root is a valuable remedial agent. The Peruvians employ it in dysentery; they long employed it as a tooth brush, to give a firmness to the gums and impart a fine red to their lips, thence the Spanish name of the plant, Ruiz para los dientes. In combination with purified animal

* The term triandria arises from one of the stamens being always suppressed.

† Journ. de Pharm. t. vi, p. 45.

charcoal, in the proportion of one part to three of the charcoal, it forms the best tooth powder that can be produced. It is not yet much employed as a medicinal Astringent; and is chiefly used, in this country, to give roughness to port wine. The dose of the root, in substance, is from gr. x to ʒss: the best form of giving it is in infusion or decoction, made with ℥i of the bruised root to a pint of water; and of this f℥ii may be taken three or four times a day. A tincture is also prepared with it, and an extract, which contains all the tannin, and, of course, all the active matter of the root. All the substances that precipitate the infusion are incompatible in prescriptions with it: these are salts of iron; acetate of lead; the mercurial salts; tartar emetic; and the mineral acids, except in small quantity. But as the alkalies merely deepen the colour of the decoction, they may be combined with it: a great advantage, indeed, in those cases of dyspepsia in which a direct bitter is not required; and in calculous affections of the kidneys. As in the case of other astringent vegetables, ipecacuanha and its preparations cannot be prescribed with infusion of Krameria.

When the decoction of Ratanhy is taken into the stomach, it tinges the fæces of a red colour, which continues for some days after the use of the medicine is discontinued. It does not affect the urine. It is a powerful tonic-astringent, but, when taken daily for some time, it is productive of uncomfortable sensations—sickness, pains in the lower belly, and costiveness; sometimes tingling over the whole skin; flying pains in the limbs, and even spitting of blood.

Ratanhy is administered with advantage in passive hæmorrhages, whether from the stomach, the chest, the nostrils, or any part of the habit. M. Barbier recommends it strongly in cases of softening of the tissue of the heart and the dilatation of its ventricles. In diarrhœa, if irritation or subacute inflammation exist in the intestinal canal, Ratanhy often produces heat of the epigastrium, thirst, cardialgia, sometimes vomiting and flatulence. These symptoms, however, and also those of the diarrhœa, gradually abate, the appetite returns, and the salutary influence of the remedy becomes apparent. But when these untoward symptoms increase in violence, then the me-

dicine should be discontinued. Ratanhy has also been found useful in leucorrhœa; and in a debilitated state of the habit, attended with profuse sweating. Administered in diabetes, it diminishes the quantity of urine; but the sweetness and other qualities of the secretion remain unaltered.

b. RUMEX AQUATICUS. *Great Water Dock.* D.—This is an indigenous perennial plant, found in ditches and on the banks of streams. It belongs to the natural order *Polygoneæ**. The roots of this Dock are somewhat tuberous, break with a starchy fracture, and exhibit a white centre, whilst the cortical part is pale yellow, covered with a reddish brown cuticle. It has a faint, peculiar odour, and an austere, bitter taste. It yields its virtues to water. The decoction strikes a black with persulphate of iron, and throws down a precipitate with lime and barytic water; iodine demonstrates the presence of a very considerable proportion of fecula in it. Gelatin detects tannin, and muriate of tin extractive. According to the experiments of Deyeux, it contains a large proportion of free sulphur.

In full doses, the decoction of this root purges; but, in small doses, it operates as an astringent. It was formerly in great repute as a remedy in cutaneous affections. In every old author who treats of skin diseases, we shall find it described under the names *Lapathum*, *Hydrolapathum*, and *Herba Britannica;* it is still recommended as a specific in various species of Dartres on the Continent; and, probably by means of the free sulphur which it contains, it has been found a tolerably certain remedy for scabies. I have had no experience of its efficacy, except in two diseases, both of which are extremely troublesome to remove by other means: I refer to Herpes labialis, when it changes into a species of Impetigo; and Ichthyosis, or fish-skin eruption. But the most useful of all our indigenous remedies in cases of Ichthyosis is another species of Rumex, much more common and generally known than the *aquaticus*, the Rumex *obtusifolius*, or broad-leaved Dock.

The decoction of the root of this plant is bitter and nau-

* Woodville's Med. Bot. third edit. p. 658, pl. 229. London Dispensatory, art. Rumex.

seous; less astringent than that of the Rumex *aquaticus*; and contains scarcely any gallic acid. It appears, from the action of reagents, to contain tannin, extractive, starch, and a bitter principle; but it also contains some purgative principle, as it operates powerfully on the bowels.

The dose of the decoction, made with an ounce of the root and one pint of water, is f℥iss, twice or thrice a day.

3. POLYGONI BISTORTÆ RADIX. *Root of Bistort.* L. E. D.—This plant, named from the form of the root, which is twice turned, *bis torta*, is very widely diffused, being found over the greater part of Europe and Asia, in all elevations, in the low, marshy grounds of this country, and on the Carpathian Alps, at a height of 4476 feet. It belongs to the natural order Polygoneæ*.

The dried root of Bistort is inodorous, and has an austere, acerb taste. The decoction of the root contains a free acid, indicated by the change which it produces on vegetable blues; and we conclude that it is gallic acid combined with tannin, as it blackens the salts of iron and precipitates gelatin. The tincture of iodine indicates that it also contains fecula; and the muriate of tin throws down extractive. Besides the tannin, gallic acid, fecula†, and extractive, this root contains also some oxalic acid, which throws down a copious precipitate with lime water.

The astringent powers of Bistort root are considerable; and it may be employed in all cases in which simple Astringents are useful. The quantity of fecula and extractive which it contains is a disadvantage to it, in keeping the decoction, and in forming what may be termed an elegant mixture; but the demulcent properties which these confer upon it render it an admirable local Astringent in leucorrhœa and other mucous discharges from the vagina. It is very seldom employed in modern practice, probably from the circumstances to which I have alluded, and partly from the uncertainty of

* Woodville's Medical Botany, third edition, p. 668, pl. 232. London Dispensatory, art. Polygonum.

† The quantity of fecula is so great, that the poorer classes of the people in Siberia employ it as food, after it has been submitted to decoction in water, to extract the bitter and astringent principle.

its powers, owing to the effect of soil and climate in modifying the secretion of its active principles. Thus, from the formation of a greater proportion of fecula and less tannin and gallic acid in the climate of Iceland, the natives of that bleak island eat the Bistort root both raw and converted into bread.

The dose of the Bistort root, in substance reduced to powder, the best form in which it can be administered, is from fifteen grains to a drachm. It may be advantageously combined with aromatics.

4. I have already described Geum *Urbanum;* therefore, although it hold a place in the Table of Astringents, yet it is unnecessary again to enter into any details respecting it. The root, which is the part used, is seldom employed as an Astringent.

5. TORMENTILLÆ ERECTÆ RADIX. *Tormentil Root.* L. E. D—This plant, were it an exotic, would be very highly prized for its astringent qualities. It is a very common indigenous, perennial plant, belonging to the natural order Rosaceæ*.

The root, which is the part of the plant medicinally employed, is thick, oblong, tuberculated, of a dark yellow colour exteriorly and reddish within ; it is inodorous, and has a very astringent, bitter taste, accompanied with a slight aromatic flavour. When distilled in water, what passes with the water imparts to it the odour of the rose. According to the analysis of Dr. Meissner of Berlin, 1000 grains of the root of Tormentil yield—myricine, 2 grains ; cerine $5\frac{1}{8}$; resin $4\frac{1}{4}$: tannin 174 ; red colouring matter (extractive ?) $180\frac{1}{2}$; red colouring matter modified $25\frac{3}{4}$; gum 282 ; gummy extractive, united with some tannin and a calcareous salt, $43\frac{1}{4}$; extractive 77 ; volatile oil, traces ; and ligneous fibre and water $206\frac{1}{2}$. Dr. Meissner gives us no idea of the nature of the red colouring matter, or rouge de tormentille, as he terms it ; and it is not easy to understand what he means by the two kinds of extractive which he has indicated. The proportion of tannin appears small in reference to its astringent

* Woodville's Medical Botany, third edition, p. 503, pl. 181. London Dispensatory, art. Tormentil.

powers. Besides the decoction and infusion of Tormentil root, it contains also *gallic acid*, as indicated by persulphate of iron. A precipitate is formed of the tannin with lime water, which, being inert, this substance is incompatible in prescriptions with Tormentil root. I mention this because I have seen prescriptions with infusion of Tormentil added to the chalk mixture, in which its astringent powers must have been destroyed. If it be requisite to combine so useful and powerful an Astringent with the chalk mixture, the Tormentil root should be in the state of powder. Except nut-galls and catechu, it contains more of the vegetable astringent principle than any other vegetable production; and on this account it is employed in the Orcades in tanning leather.

Decoction is the best form of administering Tormentil. It is chiefly useful in cases requiring the employment of Astringents, in which there exists an atony of the system:—Leucorrhœa, for example, passive hæmorrhages, and diarrhœa unconnected with any source of irritation. But it is so little stimulant, that the presence of febrile excitement does not stand in the way of its administration. In stating that it possesses little stimulant properties, it might be asked in what manner are we to explain its influence in destroying warts? a use to which it has lately been employed. For this purpose, it has been recommended in decoction prepared with ℥i of the bruised root, boiled in one scruple of water down to half a scruple. A rag dipped in this decoction should be laid over the parts, previously cleaned with tepid water. In explaining this practice, which has been recommended by Mr. Alcock, I should say that the powerful astringency of the decoction acts on the warts in the same manner as on dead animal matter; the vitality of these growths being in a low state, and incapable of resisting the astringent power of the Tormentil. On the same principles may be explained its utility as an injection in polypus of the uterus. The dose of the powdered root is from ʒss to ʒi, that of a decoction, made with ℥i of the bruised root and a fluid pint of boiling distilled water, from fʒx to f℥ii.

*** Plants.*

1. LYTHRI SALICARIÆ HERBA. *Loosestrife.* D.—This is an indigenous plant, growing in marshy places, and on the banks of rivers, flowering from June till September, belonging to the natural order Salicariæ*. In its dried state it has an herbaceous, subastringent taste, and evidently contains gallic acid, from the action of its decoction on the salts of iron. It was formerly employed in diarrhœa and dysentery, in which it was strongly recommended by Stoerck and De Haen; but it has deservedly fallen into disuse, and is retained only in one British Pharmacopœia, that of the Dublin College. It may be administered in powder, in doses of from ʒss to ℈iv, or in decoction, made with two ounces of the root and a quart of water boiled down to one pint, in doses of two or three fluid ounces.

2. BOLETUS IGNARIUS. *Agaric.* E.—This fungus grows on the trunks of trees†, especially the oak, from which it may be cut in August and September. In form, the entire fungus resembles that of the hoof of a horse; its colour is reddish-brown; it is thick, fibrous, and very tough. For astringent purposes, it is prepared by cutting it into thin slices and beating these in a mortar until it can be readily torn into small pieces. M. Bouillon la Grange has analyzed the Agaric, and found in it an extractive matter, a small quantity of resin, some animalyzed matter, hydrochlorate of potassa, sulphate of lime, and, when it was burned or incinerated, phosphate of lime and of magnesia, and some traces of iron.

Agaric is chiefly used on the Continent as an external styptic; but in this country it is scarcely ever employed.

**** Barks.*

b. QUERCUS PEDUNCULATÆ CORTEX. *Oak Bark.* L. E. D.—This noble tree, the pride of our forests, from which we derive much of our national importance as a commercial

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* Woodville's Med. Bot. 3rd edition, vol. v, p. 65, pl. 19. London Dispensatory, art. Lythrum.

† Woodville's Med. Bot. 3rd edition, vol. v, p. 808, pl. 273. London Dispensatory, art. Boletus.

people, and which floats, the bulwarks of our maritime glory, the "knotty, unwedgeable, and gnarled oak of England," belongs to the natural order Cupuliferæ*.

It is curious to trace the history of the Oak. At an early period of the civilization of our island it was cultivated as a fruit tree, and the failure of an acorn crop was accounted a cause of famine†. After this period the acorn was still of great importance to the large herds of swine, which constituted much of the wealth of our Saxon ancestry, who felt more the power of tyranny in the conversion of the forests into hunting grounds, than in all the other acts of the Norman Conqueror. Some of the aboriginal Oaks long remained to attest the great age to which this noble tree attains. The oak against which the arrow of Walter Tyrrel glanced, before it killed William Rufus, was in existence less than a century ago. The Oak still stands at Torwood, in Stirlingshire, under the boughs of which the Scottish patriot Wallace convened his followers, and awakened in their bosoms the determination of rescuing their country from the thraldom of Edward. The size to which the Oak occasionally attains is no less remarkable. It sometimes acquires one hundred feet in altitude. An Oak which was felled at Whitby Park, Shropshire, in 1697, was nine feet in diameter, without the bark: its branches spread one hundred and forty-four feet, and twenty-eight tons of timber were contained in the body of the tree. Dr. Plott mentions an Oak, at Norbury, which was forty-five feet in circumference; and when it was felled and lying upon the ground, two horsemen, one on each side of the trunk, were concealed from one another. An Oak, named Damory's, in Dorsetshire, was still larger than the Norbury tree, being sixty-eight feet in circumference.

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* (Quercus robur) Woodville's Med. Bot. p. 23, pl. 10. London Dispensatory, art. Quercus.

† Some of the species of Quercus, the Quercus Ilex, and some other species of South American growth, produce acorns which are mild and nutritive; and even the kernels of the common oak might be rendered edible by boiling them in an alkaline ley, were it necessary, in any period of famine, to resort to them as food.

This officinal species has been confounded with the Quercus robur, which, however, differs from it in having the fruit or acorns sessile; whereas, in the officinal Oak, they are supported on peduncles, or rather, pedicles, from one to two inches long, whence the trivial name *pedunculata.*

Although every part of the Oak is astringent, yet the bark of the smaller branches is the only part officinally used. Oak bark is covered with a bluish-grey epidermis, and is of a pale red colour within. For medicinal purposes, it is peeled in spring; as, at that season, it contains eight per cent. more of astringent matter than when it is cut in the autumn. This bark is inodorous, and has a rough, astringent taste, depending on the quantity of tannin which it contains. The part of the bark richest in tannin has been ascertained, by Sir H. Davy, to be the inner cortical part. He found that ℥i of this part yields 77 grains of tannin; that the cellular integument, or middle coloured part, yields 19 grains only; and the epidermis scarcely any quantity, either of tannin or of extractive*. Besides containing *tannin* and *gallic acid*, indicated by gelatin and persulphate of iron, the muriate of tin displays also extractive in the decoction†. Precipitates are also formed with lime water, carbonate of potassa, and acetate of lead; but Vauquelin ascertained, what is remarkable, that no precipitate is produced by the solution of tartar emetic, or the infusion of yellow cinchona.

Oak Bark is a valuable Astringent, whether administered internally or applied externally; and may be used in all cases requiring Astringents. The best form of administering it is that of decoction; for it is so difficult to pulverize, that it can scarcely be reduced to powder. The dose of the officinal decoction is from f℥i to f℥ii, twice or three times a day.

The Dublin College orders an extract to be prepared by

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* The bark of the Quercus *alba,* of the North American States, contains a much larger proportion of tannin than that of the common Oak. An infusion of ʒss in f℥xii of boiling water, taken in doses of f℥ii every third hour, has been found to check ague.

† It is owing to the extractive that the saw-dust of the Oak is employed as a dying material, to impart a fawn colour to cottons.

evaporating the decoction: but it is less active than the decoction, owing to the conversion of the tannin into extractive. The astringency of decoction of Oak bark, when it is swallowed, is powerfully felt in the stomach, which almost invariably suffers from cardialgia and spasm when it is given alone. Thence the internal employment of this bark is seldom resorted to; although it has been used in some of the Continental military hospitals, as a substitute for cinchona bark, in the following combination:—

℞ Pulveris	Quercus corticis .	gr.	120
———	Gallarum . .	gr.	30
———	Gentianæ Radicis	gr.	35
———	Anthem. nob. flor.	gr.	20
———	Cetrariæ Islandici	gr.	5—Misce.

This powder is ordered to be given half an hour previous to the accession of the paroxysm of ague. It is said to have proved successful in many instances; but its bulk is a great objection to its employment, and the large proportion of Oak bark renders it difficult to be retained on many stomachs.

The external application and topical use of the decoction is more frequent and beneficial than its internal administration. In prolapsus ani, in leucorrhœa, and in uterine hæmorrhage, it may be advantageously used as a lotion and injection; and as a gargle, in those states of the fauces which indicate great relaxation of the mucous membrane.

**** *Leaves.*

1. Arbutus Uva Ursi. *Bear's Wortleberry.*—Although, in treating of tonics, the leaves of this plant were mentioned, yet, as an Astringent, several circumstances require to be noticed which were not then brought forward. According to the analysis of Dr. Meissner, 1000 grains of it contain—12 grains of gallic acid; 29 of tannin, united with gallic acid; 335 of pure tannin; 44 of resin; 63½ of chlorophylle; 33½ of extractive, combined with malate of lime and of soda; 8⅝ of extractive oxydized with citrate of lime; 157 of gum; 176 of extractive; and 156 of ligneous matter and water. But, from the effect of the infusion, produced by simply triturating the leaves with cold distilled water on persulphate of iron, I

am of opinion that the proportion of gallic acid is greatly underrated in this analysis. With regard to the extractive in almost every analysis of an astringent vegetable, I am much disposed to ascribe its presence to the action of the oxygen of the air, aided by the heat which is employed in making the infusion or decoction. The action of gelatin indicates the large proportion of tannin; and we are equally convinced of the abundance of extractive, from the effect of the addition of muriate of tin to the decoction. Oxalate of ammonia indicates the presence of lime in the decoction: but, with the cold infusion, none of these results occur. Carbonate of potassa acts upon it nearly as on a solution of pure gallic acid, except that a slight precipitate takes place; and lime water throws down a gallate of lime—which is a fact of some practical importance.

As an Astringent, Uva Ursi possesses considerable powers: it is taken into the circulation, and may be detected in the urine forty-five minutes after it has been taken; and it is probable that to this circumstance it is found useful in chronic inflammation of the bladder. Mr. Brodie says he has been disappointed in its use in this disease: but I have seen it serviceable in several instances. To the absorption of it, we may also attribute its effects in preventing the formation of urinary calculi in the kidneys. It was introduced into practice for this purpose by De Haen; who, with many others, ascribed its powers to some solvent property. Dr. Cullen referred them solely to the tonic influence of the remedy on the stomach, preventing the formation of acid in that viscus: but, although there can be only one opinion, that it possesses no solvent powers, yet, as it enters the circulation, and is excreted by the kidneys, it is very probable that something is to be ascribed to its local influence as an Astringent on the kidney itself, in giving it tone, allaying inordinate action, and, consequently, producing a more healthy secretion and excretion than would otherwise take place in those states of the habit favourable to the formation of calculus. Dr. Smith Barton asserts that "it favours the expulsion of granules of calculi;" an effect that might be ascribed to its diuretic powers, which Alibert regards as its sole quality; "tout se

reduit a dire," says he, in summing up its value as a medicine, " que le Raisin d'Ours a une action manifestement diuretique dans certaines circonstances." Its action on the kidney, however, is not that of a diuretic; but that of an astringent and a tonic. It must, nevertheless, be admitted, that its influence on the urinary organs, obvious when the cold infusion is used, is chiefly due to the gallic acid which it contains. In this state, my experience has fully confirmed Alibert's view of its diuretic powers: it also more directly passes into the circulation. There can be no doubt, nevertheless, that some of the benefit derived from it, even as a diuretic, is due to its primary action on the stomach; particularly as it is generally administered in the form of powder. In this form it is given in doses of from one scruple to a a drachm, or more. It may be, however, given in the form of decoction, made with one ounce of the leaves and one pint of water; or in that of cold infusion, made by rubbing in a mortar ℥ii of the leaves with a fluid pint of distilled water. In this form, I have ordered it with great advantage in hæmorrhages of the bladder and the prostate gland.

***** *Flowers.*

1. Rosæ Gallicæ Petallæ. *Petals of the Red Rose.* L. E. D.—The well-known and elegant flower requires no description: it forms the type of the natural order Rosaceæ*. The unblown buds yield the petals for medicinal use. This rose has less fragrance than many of the other species of the genus; but the fragrance of the petals is increased by drying; and, what is curious, by the addition of iodine: the taste is agreeably bitter, and slightly aromatic. It is extraordinary that, notwithstanding the permanency of its odour, the Rose furnishes so small a portion of volatile oil. At Lucknow, in

* The beauty and fragrance of the Rose have given an interest to it in the eyes of every cultivated nation in the world; and, in some Oriental countries, the passion for it extends to a degree of luxurious indulgence that we can scarcely form any idea of in our phlegmatic climate. In Persia, it is common to recline on beds of roses in all their freshness; but the general result of such a voluptuous indulgence is a severe catarrh. Even in Morocco, as Mr. Jackson, in his account of that empire, informs us, the rich odoriferous petals of the Musk Rose are made up in mattresses for the men of rank to recline upon.

Hindostan, where the best attar of roses is distilled, not more than three drachms are procured from a hundred weight of petals, freed from every other part. The odour is communicated to a large portion of water, but no astringency accompanies it; and, therefore, the application of rose water to inflamed surfaces affords no more relief than that of common distilled water.

Boiling water extracts the odour, taste, colour, and astringent properties of Rosa *Gallica*. The infusion shews the presence of a free acid by its effects on litmus: and that this is the gallic acid, is easily demonstrated by its effect on the sulphates of iron. Gelatin indicates the presence of tannin; and muriate of tin, that of much extractive. M. Cartier has published an analysis of this rose*. He found tannin, gallic acid, a colouring matter, a volatile oil, a fatty matter, albumen, soluble salts with bases of potassa, lime, silex, and oxide of iron. The astringent properties of the petals of this Rose depends on the tannin and gallic acid which they contain†.

The influence of the petals of this Rose, as a remedial agent, is very moderate; although, at one time, they were in great reputation, and many imaginary virtues were attributed to them. They enter into several pharmaceutical preparations, namely, a conserve or confection, an infusion, a syrup, and a honey. All of these, with the exception of the honey, tend to constipate the bowels. The confection has been much recommended in chronic coughs, in which a gentle tonic and astringent is indicated, and, acidulated with sulphuric acid, in sweating connected with general debility of the system. On the same principle, the confection has been used in diarrhœa, some passive hæmorrhages, and leucor-

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* Journal de Pharmacie, t. vii. p. 527.

† A curious effect results from the gallic acid which they contain acting upon iron. If the fresh petals of the Province Rose be beaten to a pulp, in an iron mortar, for some hours, they are converted into an intense black paste, which, being rolled into little beads, and dried, become so hard that they may be polished like ebony. Beads made in this manner are exported from Turkey to Catholic countries, under the name of rose beads or rose pearls, for the purpose of forming rosaries. They retain the odour of the flower.

rhœa. As a gentle topical Astringent, the infusion, acidulated, is a useful gargle in affections of the fauces, and as a collyrium in some species of ophthalmia. The infusion of the confection is an excellent vehicle for the administration of the sulphate of quinia.

* * * * * * *Fruits.*

1. Punicæ Granati Tunica Baccæ exterior. *Outer Rind of the Pomegranate.* L. D.—The Pomegranate is well known in the conservatories in this country, and is even naturalized to the variable state of our atmosphere: it is a native of those shores which are bathed by the waters of the Mediterranean; thence its name *Punica*, imposed by the Romans, who first saw it in the neighbourhood of ancient Carthage. It is now cultivated in the milder regions of Europe, and in the East and West Indies, where the fruit is both larger and higher flavoured than in the native country of the plant. It belongs to the natural order Myrtaceæ*.

In England the Pomegranate seldom grows beyond the magnitude of a shrub. The fruit is mentioned by Theophrastus and Dioscorides under the name of *Roa;* by Hippocrates under that of Σιδιον; and by Celsus, *Punica Malum:* it is about the size of an orange, globular and crowned with the remains of the calyx. The rind, which is the part employed as an Astringent, is coriaceous, of a reddish-yellow colour, and having a very styptic taste. The pulp which it covers is succulent, contained in cells divided by membranes, and crowded with seeds. It is red, pleasantly acid, cooling and gently aperient. All the other parts of the Pomegranate plant are astringent; and, as an exception to the other individuals of the natural order to which it belongs, the leaves of the Pomegranate contain no volatile oil, but much tannin. The bark of the fruit is sometimes called *Malicorium;* the petals, also, are medicinally employed under the name of *Balaustines:* they are inodorous, have a strong, acerb taste, and contain a large quantity of tannin and gallic acid: their action on the system is tonic and Astringent.

* Woodville's Med. Bot. 3rd edition, p. 531, pl. 190. London Dispensatory, art. Punica.

Balaustines afford a red, aqueous infusion, which the sulphates of iron blacken. The infusion has been employed with great advantage as a gargle in relaxation of the uvula and inflammation of the fauces; and is internally administered in chronic diarrhœa. In the last-mentioned disease, Balaustines have been given in the form of powder, suspended in mucilage of quince seed; or the decoction, in conjunction with the same mucilage, may be exhibited as an enema. The bark of the fruit possesses the same astringent properties as the *balaustines*, but in a higher degree. It imparts a rough bitter taste when chewed, and communicates its properties to water. From the deep black blue which it strikes with the sulphates of iron, and the slight precipitate which it affords with gelatin, it appears to contain more gallic acid than tannin. According to the analysis of Mitouart, it contains tannin, gallic acid, wax, and a saccharine substance, one part of which is soluble in alcohol and crystallizable, the other soluble in water. The decoction of the malecorium is precipitated by carbonate of potassa, but not by the pure potassa; thence, if an alkali is requisite to be given along with pomegranate bark or balaustines in decoction, the pure alkalies must be employed. Lime water precipitates the decoction; and, owing to the tannin which it contains, it is also precipitated by sulphuric acid copiously, and muriatic slightly, but not by nitric acid.

The bark of the Pomegranate is a remedy of great antiquity in chronic diarrhœa, and in the protracted stage of dysentery. Locally employed, it forms a useful injection in leucorrhœa when no inflammatory symptoms are present, and as a gargle in relaxation of the uvula and the veil of the palate. The best form of administering the Pomegranate Bark is decoction, made with ʒiv of the powdered bark in f℥vi of water.

In Hindostan, where the Pomegranate was introduced from Persia, the bark of the root has been long medicinally employed, chiefly as a remedy for the expulsion of tape worm; and, according to M. Deslandz, the negroes of St. Domingo use it for the same purpose. If the accounts that are given of it be correct, it is surprising that it has not

been long since introduced into this country*. It has been lately admitted into the list of Materia Medica of the Dublin College. This bark is of a yellow colour within and an ash grey on the exterior. On analysis, it yields the same principles as the Malecorium. It may be administered, in the form of powder, in doses of eight grains to a scruple, twice or thrice a day. The decoction, which is employed in India, is made by boiling ℥ii of the bark, in a pint and a half of water, down to f℥ix, of which f℥ii are given for a dose, every half hour, until the worm is expelled, which generally occurs in twelve hours after the first quantity has been administered. It is the bark of the root of the wild Pomegranate which is generally employed; but M. Pichonnier asserts that the fresh root of the cultivated plant is equally efficacious. The decoction appears to excite considerable nausea, probably owing to its strength; and, as smaller quantities appear to answer the same purpose as the larger doses, there is no necessity for making the decoction so strong. In many instances, even in weak doses, it excites powerfully the intestinal canal, causing griping. It also acts on the nervous centres, producing vertigo, tremblings, and the sensation of intoxication, with weariness in the thighs and legs, and other symptoms indicative of a poisonous quality in the bark. Mr. Breton, who published a paper on this subject†, mentions that he placed live tæniæ in the decoction of the bark of the Pomegranate root, and also in a mixture of the powder of the root in water, and observed that " the instant they (the tæniæ) were plunged in these preparations, they writhed, and otherwise manifested great pain, and died in the space of five minutes." That their death, in these cases, arose from the influence of the bark is evident, as these worms live several hours after expulsion, when kept in plain tepid water. It is not, however, easy to say how much of this effect is due to the astringency of the bark. It possesses chemical properties different from those either of Balustines or the Malecorium. When it is moistened with a little water and

* Celsus informs us that the ancients used it as a vermifuge.—De Medicina, lib. iv, § xvii.

† Medico-Chirurg. Trans. vol. xi, p. 301.

rubbed upon paper, it leaves a yellow trace, which passes to a deep blue when touched with sulphate of iron: these traces, moistened with an acid, acquire a rose tint, which soon disappears, leaving a dull brownish-yellow colour. If experience shall confirm its efficacy in tape worms, this bark will soon supersede the use of the essential oil of turpentine, the intoxicating effects of which, when taken in the dose necessary to expel tæniæ, is a great objection to its employment.

2. PRUNI SPINOSÆ FRUCTUS. *The Sloe.*—This is one of the few fruits indigenous to our climate. The plant is a shrub, common in hedge rows, and, like the rest of the genus to which it belongs, flowering in March and April, before the leaves appear. It is arranged in the natural order Amygdaleæ.* The fruit is a drupe, about the size of a large pea, of a black colour, covered with bright blue bloom. It has a sharp, austere taste.

As an Astringent, the Sloe was employed in the time of Dioscorides, and is still used as a domestic remedy, although it has been rejected from the Pharmacopœias. It has one advantage over many other substances in this class of remedies: it exerts no stimulant influence, and, therefore, may be administered even when inflammatory symptoms exist. It has been recommended in diarrhœas, especially in those of a chronic character, such as are often brought on in India; in hæmorrhages, and as a topical Astringent in enlargements of the tonsils and relaxation of the uvula. It was formerly administered as a conserve; but the inspissated juice of the unripe fruit, or a tincture in proof spirit, is preferable. The inspissated hardened juice may be given in powder, in doses of from eight grains to a scruple, three or four times a day.

* * * * * * * * *Vegetable Secretions.*

1. KINO. L. E. D.—The Kino, originally introduced into the list of Materia Medica of the British Colleges, came from Africa; and, from a specimen sent home by Mungo Park, it has been ascertained to be the juice of a species of

* Woodville's Med. Bot. 3rd edition, p. 518, pl. 186.

Pterocarpus, which De Candolle has described in the Encyclopédie Methodique, under the specific name *Erinacea**. The London College, overlooking the fact that scarcely any of this kind of Kino is now found in the market, has designated this plant, in their Pharmacopœia, as the only source of Kino. The Edinburgh College, in its Pharmacopœia, has put down Kino as the production of the Eucalyptus *resinifera*, a tree which is a native of New Holland and Van Dieman's Land, belonging to the natural order Myrtaceæ. This astringent substance resembles Kino in many respects, and even in the effect of reagents upon it. It is not Kino, however, nor an extract, but exudes spontaneously from the tree, in the manner of some gums, and is inspissated in the sun. It may, nevertheless, be extracted by decoction; and some has been sent home prepared in this manner. It differs from Kino in being less easily pulverized, and in adhering to the teeth when chewed.

The Dublin College formerly considered Kino as the production of the Butea *frondosa*, a very beautiful plant, a native of the coast of Coromandel; but the red juice of this plant is certainly not Kino; and the Dublin College, convinced of this, has now left the plant unnamed.

The greater part of the Kino now found in commerce is the inspissated juice of the Nauclea *Gambir*, a plant which is a native of India, belonging to the natural order Rubiaceæ†. The Kino is neither a gum nor a resin, but a dry extract; it is prepared from the leaves and the young twigs of this Nauclea, which are boiled in water for an hour and a half, and the decoction repeated with fresh quantities of water; the combined decoctions are then inspissated to the consistence of honey. This thickened juice is next poured upon plates, and when it is sufficiently solidified, it is divided into small portions, and the drying completed by exposure to the sun, taking care to turn the mass regularly and frequently. Another process consists in infusing the leaves and young twigs, for some hours, in water: the infusion,

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* Woodville's Med. Bot. 3rd edition, vol. v, p. 44, pl. 12. London Dispensatory, art. Kino.

† Linnæan Trans. vol. ix.

when inspissated, forms a feculent deposit which is moulded into little cakes. These are very rarely found in the European market, but the first preparation is brought home in considerable quantity.

The *East India Kino*, the production of the Nauclea *Gambir*, is sometimes in irregular masses, dry and brittle, dividing readily into smaller pieces: sometimes it is in small brittle fragments, apparently the larger masses broken down, of a deep uniform brown colour, shining and breaking with a vitreous fracture, exhibiting sometimes small cavities in the interior of the pieces. The colour and exterior aspect of the Kino of the Nauclea *Gambir* varies in the different parts of India where it is made. Hunter says that that made in Sumatra and on the coast of Malabar is lighter coloured than that which is made elsewhere. It is easily pulverized, and affords a powder of a brown chocolate hue. When in the solid state, this species of Kino is inodorous; but, when dissolved in boiling water, it exhales a slight bituminous odour; when chewed, it scarcely colours the saliva, and has a slightly bitter, astringent taste.

The *New Holland Kino* is procured by wounding the Eucalyptus which yields it, and allowing the juice which exudes to dry in the sun. It is bitterish and astringent to the taste, breaks with a glassy fracture, and affords a brown-coloured powder.

As scarcely any *Jamaica* or *African* Kino can be procured, it is unnecessary to describe these varieties*.

All the varieties of Kino are much more soluble in hot than in cold water; and, in cooling, the water lets fall a precipitate, which agglutinates into masses that can be softened by heat. This residue of the aqueous decoction is insoluble in alcohol and cannot be fused by heat. The aqueous solution is clear and transparent. Alcohol dissolves nearly the whole of the *East India Kino*, forming a deep claret-coloured tincture which is not resinous, and is not rendered turbid on the addition of water. It is also very soluble in ether; and the solution, when poured on water, leaves no resinous pellicle on the surface of the water. The *Botany Bay Kino* yields only two parts in three to alcohol, and forms a deep brown

* Both are described in the London Dispensatory, art. Kino.

tincture. Ether dissolves about one twentieth, and forms a brownish straw-coloured solution, which leaves a thin resinous pellicle when it is evaporated in water. The solutions of Kino are affected by the reagents which demonstrate the presence of tannin in other astringent vegetable solutions; but the results differ in some particulars, showing that the tannin exists in a particular state.

Gelatin throws down a precipitate of a rose colour; *persulphate of iron*, instead of a black, strikes a deep green hue, and the precipitate is unalterable in the air; *permuriate of mercury* throws down a reddish precipitate. The alkalies produce no precipitates; but they deepen the colour: copious precipitates are thrown down by their carbonates: all the *mineral acids* produce brown precipitates.

I might here mention the analysis of Vauquelin; but it was made with the Kino obtained from the Coccoloba *uvifera*, a tree growing in Jamaica; and is not that generally found in the shops. In chemical properties, however, all the varieties of Kino so far accord, that we may safely pronounce their constituents to be tannin, extractive, and a peculiar principle insoluble either in water or alcohol. The Kino which most resembles that now generally found in commerce is that of the Eucalyptus and that of the Cocoloba *uvifera*, which Dr. Duncan has incorrectly asserted to be the Kino of commerce.

Kino is a valuable Astringent in all cases that require the aid of Astringents; although Dr. John Davy maintains that it possesses little power on the animal œconomy when given alone. It was introduced into medicine by Dr. Fothergill, on account of its astringent properties; it is employed in diarrhœas when they are kept up rather by general relaxation of the intestinal canal than by irritation of the mucous membrane. It is said to be less effective than catechu; but this is not in accordance with my experience; and I cannot readily perceive upon what ground it should not be at least an equally useful Astringent. Dr. Pemberton recommends it highly in combination with opium in pyrosis; a disease accompanied with pain at the stomach, a sense of constriction, and the discharge by the mouth of an insipid watery fluid, the consequence of spasm of the muscular coats

of the stomach, on the relaxation of which a large quantity of fluid is poured out from the exhalants. The opium of itself relieves the pain and spasmodic part of the attack; and the intention of the Kino is to give tone and, consequently, to allay irritability. Dr. Pemberton prefers it to other vegetable Astringents, "because," says he, "in this drug you have a medicine which exerts its power to restrain the discharge of the glands, when they are secreting too much, without exerting any such powers on the glands when they are acting naturally." Without criticising too closely the hypothetical nature of this explanation, there is no doubt of the efficacy of this application of Kino and its use in dyspepsia. It may be administered either in substance or in infusion or tincture. The dose in substance is from gr. x to ℈i, that of the infusion f℥xii, and of the tincture made with proof spirit f℥i. In prescribing Kino, it should be known that the alkalies destroy its astringency, and that it differs from some of the other vegetable Astringents, in throwing down precipitates with bichloride of mercury as well as with tartrate of antimony and potassa.

The local and external employment of Kino has been much neglected in this country and in Europe. Its peculiar properties adapt it for many cases of local affections: for gargles in relaxation of the uvula, and as a dentifrice, in combination with charcoal, in a spongy state of the gums. The Malays apply it externally to cure burns and other abrasions of the skin; and I can bear testimony to its utility, when employed as a styptic, to give tone and to diminish the ichorous discharge of flabby ill-conditioned ulcers. In some respects, in these cases, the tannin operates nearly in the same manner as on dead animal matter, by coagulating the albumen and forming a kind of covering from the air; whilst, at the same time, its tonic influence on the living system tends to counteract that state which is always the attendant, if not the predisposing cause of gangrene.

If Dr. Pemberton's view of the mode in which Kino operates were correct, that "it contracts a vessel too much relaxed to its natural standard, but that it is unable to contract it any farther," it might be most advantageously employed

in gleet. But the remark requires to be more narrowly examined before it can be implicitly acted upon.

2. CATECHU. L. E. D.—This is a substance which was originally brought from Japan; and, being regarded as an earth, was called Terra Japonica. It is now imported from Bengal and Bombay, and is known to be an extract of the wood of the Acacia *Catechu*, a tree of the natural order Leguminosæ*. It is a solid, brownish, infusible substance, very astringent, and heavier than water.

The whole of the tree yields Catechu; but it is prepared only from the interior hard, brown, or heart wood. It is obtained by boiling the chips of the wood in water, evaporating the decoction, and, finally, inspissating it in the sun until it is brought to a considerable thickness, when the mass is spread out on a mat, previously covered with the ashes of cow's dung; and being divided into square pieces by means of a string, these are hardened by a farther exposure to the sun†. It has been stated by Dr. Duncan, and is generally believed in Europe, that another species of Catechu is procured in Mysore, from the areca nut; but Dr. Wallich has informed me that this is a mistake, and that all the other kinds are the productions of other species of Acacia. It is well known that a species of tannin, termed *Bablah*, is prepared in Upper Egypt from the pods of the Acacia Arabica. Indeed, almost all this beautiful and extensive family of plants yield tannin‡.

Catechu is imported into this country from Bengal and Bombay. The varieties are distinguished as pale and dark. The first kind, or pale Catechu, is generally in small square cakes, of a pale, reddish-brown colour; light and friable; breaking with a rough fracture; its taste is at first bitterish and astringent; but, after being chewed for a short time, it leaves a sweetness on the palate. The second kind, or dark

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* Woodville's Med. Bot. 3d. edit. p. 433, pl. 157. London Diepensatory, art. Catechu.

† Mr. Kerr, who first gave the public correct information on the origin of the Catechu, says that the name is a compound of two Oriental words, *Cate*, which signifies a tree, and *Chu*, which signifies juice.

‡ In South America, a substance is procured from the Cinchona *excelsa* which closely resembles Catechu.

Catechu, is generally in balls, or roundish masses, having a reddish or iron-rust colour externally, and a deeper colour within, often streaked or marbled. It is less bitter than the pale kind, and leaves more sweetness on the palate. The third sort is in larger and more irregular masses than the other two kinds; and these masses are frequently covered with leaves. The colour is a deep chocolate or black; the fracture is shining and resinous. The taste of this species is bitter and astringent like the first, and impresses the same sweetness on the palate as the two other kinds. I am of opinion that these diversities depend on the mode of preparation; and that all the kinds, as they are termed, are mere varieties of the same substance. Catechu is also distinguished by the name of the Presidency whence it is exported; as, for instance, Bengal and Bombay Catechu. The former is lighter than the latter, its sp. gr. being 1.28; and that of Bombay 1.39.

Sir Humphrey Davy examined the chemical properties of Catechu, and found that very little difference exists between the varieties. 100 grains macerated in 18 ounces of water, left $7\frac{1}{4}$ grains only undissolved; and these were impurities, consisting of carbonate of lime, aluminous earth, and sand. The solutions of Catechu vary in colour according to the variety from which they are made; all of them are inodorous, slightly redden the tincture of litmus, strike a deep green with persulphate of iron, but scarcely affect the protosulphate, and throw down copious precipitates with gelatin, the concentrated sulphuric and muriatic acids, alum, nitrate of potassa, sulphate of magnesia, acetate of lead, tartar emetic, and several neutral salts. When the fine powder is washed, until the water, which comes off no longer, precipitates gelatin, what remains is extractive. It is of a pale reddish-brown colour, inodorous, and impressing a slightly astringent, sweetish taste on the palate. The aqueous solution of this extractive does not redden the tincture of litmus, demonstrating that the effect of the solution of the entire extract on this vegetable colour is due to the tannin: it renders the persulphate of iron green, throwing down a precipitate which becomes black on exposure to the air. From the effect of these

reagents, it is evident that this is not pure extractive; and there is also some reason for believing, with Dr. Bostock, that Catechu contains gallic acid, although in very small quantity. Alkalies and the carbonates destroy the astringent property of Catechu. According to the analysis of Sir H. Davy, the constituents of Catechu are of

Tannin in Bombay Catechu	109	in Bengal 97
Extractive . . .	68	. . 73
Mucilage	13	. . 16
Impurities . . .	10	. . 14
	200	200

The mucilage may be separated by digesting the Catechu in alcohol, which takes up the extractive and tannin, and leaves the mucilage undissolved. The alcoholic solution does not throw down a precipitate when water is added to it.

As an astringent remedy, Catechu is one of the most valuable of its class for internal administration. The dark-coloured or Bombay Catechu is the best for medicinal use, owing to the proportion of tannin being greater than in the pale or Bengal variety. It is useful in all cases in which the employment of Astringents is indicated; particularly in cases of chronic diarrhœa. As a local remedy, it is almost specific in those cases of relaxation of the uvula which, from the irritation excited by the lengthened organ irritating the glottis, are attended with a teasing cough. This has not only been mistaken for phthisis, and treated accordingly, but, from the continued irritation kept up by it in habits predisposed to tubercular consumption, this cough has been the exciting cause of that intractable and hitherto fatal disease. In the hoarseness of relaxation to which almost all the public singers are liable, nothing is more useful than Catechu. It is scarcely necessary to say that, in all cases attended with inflammatory symptoms, Catechu ought not to be prescribed. Its tonic powers are considerable; and in those cases of dyspepsia which are attended with relaxed bowels, I know of no better remedy.

In diarrhœa, and similar diseases, Catechu may be given in infusion; and, in general, this infusion is combined with opium and aromatics; but, for the reasons mentioned in treating of

tormentil and of kino, when given in combination with chalk mixture, or with opium, the infusion is a bad form of preparation; and the powder should be used. This is particularly to be attended to in prescribing tincture of opium with the Catechu, or any of the salts of opium; as, in all these cases, an insoluble tannate of morphia is thrown down. This is the case also with emetina: Ipecacuanha, therefore, cannot be prescribed in aqueous solutions of Catechu; the emetina being the active principle of the ipecacuanha, and being thrown down as an inert tannate. The tincture, being free from mucilage, is more astringent than the infusion, and may, therefore, be preferred to it when the nature of the case does not forbid the use of spirits. I need scarcely repeat that alkalies are incompatible with Catechu when its astringent influence is required; and, independent of this, I know not for what it can be prescribed.

The London and Edinburgh Colleges order a compound infusion of Catechu with cinnamon bark; but the oil as an oleo-saccharum would be a preferable addition. Both these colleges also order a tincture into which cinnamon enters; and here it is less exceptionable. The electuary ordered by the Edinburgh and the Dublin Colleges contains opium, the utility of which may be questioned, particularly if the electuary be given in solution.

The dose of Catechu, in substance, is from gr. x to ʒi, or more: that of the officinal infusion, from fʒx to f℥ii; and that of the tincture from fʒss to fʒii.

GALLÆ. *Galls.* L. E. D.—The leaves of the oak, of every species, display small excrescences on the petioles, produced by an insect, the Cynips *Quercifolii*, which wounds the part and deposits its eggs in the puncture. This insect, the *Diplolepsis Gallæ tinctoriæ* of Geoffroy and Olivier, is a small hymenopterous fly, with a fawn-coloured body, dark antennæ, and the upper part of the abdomen of a shining brown. The ovipositor, as it is termed, of the female, is long, slender, articulated, and so flexible that it is rolled up spirally, and concealed within the abdomen, when the insect is not using it: but it is so admirably constructed that it can be made stiff and firm at the pleasure of the insect. With this little in-

strument the cynipis punctures the leaf-stalk of the oak-leaf, and deposites, in the puncture, an egg too small to be seen by the naked eye, and probably, also, a drop of some irritating fluid. In a few hours, the irritation which is induced in the part causes an afflux of fluids to it: the Gall rises, and, in a day or two, attains its full size. Few things puzzled the ancient philosophers more than the formation of Gall nuts. Some of them ascribed them to spontaneous generation: those who reasoned more correctly from facts, knew that the insect proceeded from an egg; but they could not conceive how the egg was conveyed into the middle of a substance which had no external orifice; they consequently inferred that the eggs were deposited in the earth, and taken into the plant by the roots; and, being carried forward in the sap, were deposited in the parts in which they were hatched. Redi went so far as to suppose that a vegetative soul exists in plants, and that to it the charge of creating the larvæ found in Galls was committed—an absurdity too gross to deserve the slightest commentary.

It is puzzling to conceive how the insertion of so minute a body as the egg of the cynips should cause so singular a divergence from the ordinary growth of the part. The simple puncture, and the mere mechanical irritation, are not sufficient to explain the phenomenon in a satisfactory manner: I am, therefore, disposed to think that some acrid secretion is injected from the ovipositor along with the egg, which, acting locally, like the vaccine virus, or any other acrid lymph that, in the animal body, produces a specific local change in the structure of the part, is the chief cause of the irritation. Not the least singular circumstance is the rapidity of the growth of the Gall, which, however large, attains its full size in a couple of days: and this is another reason for supposing that there is some fluid injected along with the egg, as the larva is not yet hatched. After a certain period the egg enlarges, the larva is hatched, and, deriving its nourishment from the Gall, after some time, it eats its way out of its prison; which then becomes lighter, and contains much less of the astringent principle: the Galls, therefore, which have a hole in them, being lighter and drier than the entire Galls,

should be separated from the others. The best Galls are gathered before the fly has issued from them; and from Galls of this kind the most perfect specimens of the insect are frequently procured*.

The Oak, on which the best Galls are formed, is the Quercus *infectoria*, a small tortuous tree, which grows in Asia Minor, and which is well described by Olivier†. Never more than one ovum is deposited in the Gall; this fœtal habitation being what entomologists term monothalmous.

The best Galls are those of Aleppo, Smyrna, Magnesia, and Natolia: they are termed *black*, or *green*, or sometimes *blue*, Galls: the worst, those through which the insect has eaten its way out, are called *white Galls*. The Galls formed on the common Oak, Quercus *Robur*‡, Quercus *Cerris*, and other species of Quercus in this country, are small, smooth on the surface, polished, reddish, and are not used§.

Galls are nearly globular in their form, varying in size, from that of a pea to that of a large hazel nut. They are studded with tuberosities; they should be of a blackish-blue, or very deep olive colour, heavy, compact, brittle, and breaking with a flinty fracture. Their internal structure displays a crystalline aspect. They yield the whole of their active matter to water; the residue being inert and insipid. Alcohol also takes up a considerable portion of the active principle.

Galls contain a large quantity of tannin and gallic acid. The aqueous infusion reddens litmus, demonstrating the presence of the gallic acid in a free state. Sir H. Davy found 130 grains of tannin, 31 grains of gallic acid and extractive, 12 of mucilage, and 12 of saline and earthy mat-

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* A different insect, a species of the genus *Chalcis*, is also sometimes found in the Gall-nut; but this is the larva of a parasitic fly, which punctures the Gall in its green state, deposites its egg in the body of the larva of the Gall fly, and destroys it.

† Woodville's Med. Bot. 3d edit. p. 23, pl. 10.

‡ Olivier, Voyage dans l'Empire Ottoman.

§ Some Galls, on other plants, are formed by beetles; such, for example, is that formed on the wild mustard, Sinapis *Arvensis*, by the Curculio *contractus*. Others are formed by Tipudæ, as those on the ground ivy and wild thyme; and some by other insects.

ters, in 500 grains of Galls: but Royer states that he obtains 125 grains of pure gallic acid from 500 grains of the Galls: but Dr. Duncan thinks that Sir Humphrey has estimated the quantity of tannin too low: in one experiment, with 500 grains of Gall nuts, Duncan obtained 220 grains, and, in another, 256 grains of soluble matter. Muriate of tin shews the presence of extractive: but the presence of mucilage is problematical. Braconnet has discovered in Galls a new acid, which he has called *Ellagic*, a word derived from reversing the word *Galle*, in French, and adding the syllable *ic*—a singular and whimsical innovation in nomenclature. This acid possesses peculiar properties, is insipid, inodorous, white, with a slight tinge of red; and is insoluble in boiling water, on which account it is readily separated from gallic acid in the process of obtaining it. When ellagic acid is mixed with nitric acid, and gently heated, the mixture acquires a red hue, and ultimately becomes blood-red. It is owing to the presence of this acid that nitric acid, added to the infusion of Galls and of oak bark, produces a blood-red colour. In this respect it might be confounded with brucine. In the infusion of Galls, the application of heat causes the partial decomposition of the nitric acid, and both the gallic and the ellagic acids are converted into the oxalic acid. This decomposition is rendered obvious by an effervescence and the odour of nitrous acid which is emitted.

In preparing Galls for medicinal purposes, it is of importance to obtain the astringent matter as free from the other ingredients with which it is combined as possible: the Galls should, therefore, be simply infused in distilled water, of a temperature not exceeding 180°: this takes up the whole of the tannin and the gallic acid, and is not loaded with extractive, formed from the oxidizement of the tannin, which is the case when the Galls are boiled; and, besides this oxidizement of the tannin, a part of it is converted into a *tannate of starch*, which precipitates as the decoction cools*.

The incompatible substances with infusion or decoction of Galls are very numerous. Many substances form precipi-

* The infusion in cold water is a very delicate test of the presence of iron in any liquid; and it is also an excellent test of the presence of morphia.

tates with these preparations besides those which indicate the astringent character of the Galls. Thus they are precipitated by infusion of cinchona, cusparia, and calumba root; solutions of opium, lime water; carbonate of potassa; the acetates of lead; sulphates of copper and of iron; nitrate of mercury and of silver; and tartrate of antimony; all of which are, therefore, incompatible in prescriptions with it. The sulphuric and muriatic acids also produce flaky, white precipitates. Nitric acid merely changes the colour, first to deep orange and then to pale orange or yellow; the astringency of the infusion is also greatly weakened: I am therefore disposed to think that, besides the action of the acid in the ellagic acid, the tannin is oxidized at the expense of the acid, and changed into extractive, whilst oxalic acid is formed from the gallic acid. Although the nitrate of mercury throws down a clotted, bright yellow precipitate, yet the bichloride, which is more likely to be ordered, in conjunction with the infusion of Galls, only renders the infusion milky. It is curious that so copious a decomposition of tartar emetic should take place on the addition of the solution of that salt to infusion of Galls, when no precipitate is produced in decoction of oak bark. No precipitates are thrown down with infusions of quassia, gentian, canella alba, orange peel, saffron, nitric acid, ammonia, sulphate of zinc, and bichloride of mercury, which may, therefore, enter into prescriptions with infusions of Gall nuts. By distillation per se, Galls have been found to yield a concrete volatile oil, which Professor Branchi, the discoverer, regards as a component of Galls: but I am inclined to consider it the production of the operation*.

As an Astringent, Galls possess all the properties which can be expected from medicines of an Astringent character. from their acerbity, they are, however, seldom used as an internal medicine in this country. They enter the circulation, but produce a primary styptic influence upon the stomach, which, when the dose of the medicine is large, greatly incommodes the organ: thence, when internally administered, Galls are generallycombined with other substances. In com-

* A solution of Galls in ether is the most delicate test of the presence of salts of iron.

bination with aromatics, they are used in India for curing intermittents; and, in cases in which the cinchona and sulphate of quinia have failed, I am surprised that they are not resorted to in Europe. As an external application, in the form of gargles, in relaxations of the fauces, in that of lotions, in leucorrhœa and similar discharges, and even as ointments, their use is most extensive; and a tincture is ordered by the Edinburgh and Dublin Pharmacopœias: it may be regarded chiefly as a spirituous solution of the gallic acid, with a small proportion of the tannin: it is a powerful Astringent. The Unguentum Gallarum, of the same Pharmacopœia is an objectionable preparation.

Powder is certainly the best form of administering the medicine. The dose may be from gr. x to ℈i. It is almost unnecessary to remark, that Galls ought not to be powdered in an iron mortar.

Ruspini's Styptic, one of those medicines which are known by the name of Patent, the preparation of which is kept secret, and which are often little more than frauds of designing knaves on the credulity of the public, owes its powers to gallic acid. Whilst we may declaim against the principle which has withheld the formula from the public, we cannot deny the value of the preparation as a powerful astringent. I have not witnessed its influence as an internal or general astringent; but I have frequently witnessed its power in checking the most obstinate bleedings from leech bites in children, after all other things had failed. This styptic consists of gallic acid, a small proportion of sulphate of zinc and of opium, dissolved in a mixture of alcohol and rose water. In proof of this, the same reagents which affect Ruspini's Styptic, affect, in the same manner, a simple solution of gallic acid in alcohol. It yields a brownish-green precipitate with lime water, which is redissolved by an excess of the lime water, and acquires a reddish hue: and it strikes a beautiful deep blue with the mixed sulphates of iron. As the quantity of sulphate of zinc and of opium is too small to influence the medicine, a simple solution of gallic acid in diluted alcohol will answer all the purposes of this celebrated and expensive styptic.

b. HEMATINE.—This substance, which cannot be regarded as a simple principle, was discovered by Chevreul. It is obtained in white, reddish, or pink crystals, which are inodorous, bitter, acrid, and astringent, soluble in water, but not in strong alcohol. Sulphuric acid and hydrochloric acid change the colour of the solution to yellow; nitric acid produces a yellow, which at last passes into red. Phosphoric, carbonic, acetic, and tartaric acids also produce a yellow colour in the solution; boracic a red; the mineral acids a reddish-purple, but, in excess, a violet-blue, which changes to a dull red, and finally to brownish-yellow, and the Hematine is decomposed. If sulphuretted hydrogen be mixed with the solution of Hematine, it produces a yellow colour, which disappears in the course of a few days. Gelatin throws down reddish floculi in the solution.

Chevreul procured Hematine by digesting logwood in water at 125° Faht. for several hours, then filtering the solution, and digesting the residue procured by evaporation in alcohol of sp. gr. 837 for 24 hours. This alcoholic solution, filtered and concentrated to the consistence of an extract, is to be again dissolved in a small quantity of water, then evaporated in a gentle heat, until the solution become sensibly thick. This is to be redissolved in a small quantity of distilled water, and left to crystallize. The crystals are to be washed in alcohol, dried on bibulous paper, and preserved in well-stopped phials.

HÆMATOXYLON* CAMPECHIANUM, *The Logwood Tree*, L. E. D.—is a native of South America, growing abundantly in the Antilles and in the Bay of Campeachy, whence it derives its specific name. It belongs to the natural order Leguminosæ†.

The wood is imported into this country chiefly as a dye stuff. It is hard, and susceptible of a fine polish; is of a deep reddish-brown colour, inodorous, and impressing a

* The genus Hæmatoxylon derives its name from the colour of the wood of this its only species, from the two Greek words *αιμα* and *ξυλον*, of which it is compounded, signifying *blood tree*.

† Woodville's Med. Bot. 3d edit. p. 455, pl. 163. London Dispensatory, art. Hæmatoxylon.

sweet taste on the palate. The astringent and the colouring principles of Logwood are given out both to water and alcohol. The aqueous solution made by boiling is of a deep red-purple colour. It exhibits some singular effects on reagents, which are partly owing to the tannin and extractive it contains, partly to the Hæmatine.

Persulphate of iron strikes a deep bluish-black, and slowly forms a precipitate of the same colour; sulphate of copper throws down a copious brownish-black precipitate; acetate of lead, a reddish black; the mineral acids produce slight reddish brown precipitates; the alkalies deepen the colour of the decoction; alum throws down a copious purple precipitate; lime water a deep purple.

The aqueous solution of Logwood, and also that of the extract ordered in the Pharmacopœias, forms precipitates with the solution of tartrate of antimony and potassa, and of sulphate of magnesia; thence both these and the reagents which form precipitates with the decoction and extract are incompatible in prescriptions with them.

Such are the chemical properties of Logwood: as a remedial Astringent, it is mild in its action; it has been found useful in chronic diarrhœa, and in giving tone to the system in convalescence from dysentery. In the cholera of infants, the infusion is beneficially administered, in doses of a tablespoonful every third hour. Like some other vegetable infusions, containing colouring matters in combination with extractive, it passes through the kidneys, and may be detected by alkalies in the urine. It is almost unnecessary to say that, in prescribing Logwood as an Astringent, the decoction and the extract ought not to be united with the chalk mixture, nor with lime water.

The dose of the extract in substance is from gr. x to ʒss, that of the decoction from f℥iss to f℥iii.

* * INORGANIC PRODUCTS OPERATING AS TONIC ASTRINGENTS.

These are chiefly acids and metallic salts.

Acids.

1. SULPHURIC ACID. *Acidum Sulphuricum.* L. E. D.—

For medicinal purposes, as an Astringent, this acid requires to be largely diluted. In the proportions ordered by the London College, there should be eighty grains of the strong acid in one fluid ounce of the diluted acid ; but these proportions vary according to the specific gravity of the acid employed—a fact which is too little attended to in making the diluted acid. The sp. gr. of the strong acid should be 1.845, and, when it is weaker, it should be boiled in a flask, to dissipate the water and to bring it to this strength, before the diluted acid be made. The strong acid always contains a small quantity of sulphate of potassa, derived from the nitrate of potassa employed in manufacturing it ; but sometimes sulphate of potassa is added to weak acid, to increase its specific gravity. When this is suspected, the fraud may be detected by saturating a given quantity of the acid with ammonia, and then exposing the mixture, in a crucible, to a red heat: the sulphate of ammonia, being volatile, is expelled, whilst the sulphate of potassa is left in the crucible, and its quantity may be thus easily ascertained. As a medicinal agent, the acid is not injured by the small quantity of sulphate of potassa which it obtains in the preparation of the acid ; nor is the salt of lead, which it also contains, any detriment; for, as the acid cannot be administered in an undiluted state, the sulphate of lead is never retained in the diluted acid. Indeed the best mode of purifying sulphuric acid is to dilute it, and then to distil off the water from the decanted diluted acid. It should always be permitted to cool before the diluted acid be decanted from the precipitate.

The diluted acid is administered, in doses of from m. vi to m. xxx, or more, in f℥iss of water, or infusion of roses, or infusion of confection of roses, or in the same quantity of mucilage of acacia gum, or in any bitter infusion, to operate as an Astringent. In some cases—as, for example, malignant erysipelas with a tendency to hæmorrhage—it may be carried to any dose that the patient can bear. I have given it to the extent of f℥ss, in the space of twenty-four hours, in uterine hæmorrhage. Its action as an Astringent is not easily comprehended without referring to its operation as a local stimulant: when diluted sulphuric acid is locally applied to any

part of the body, it contracts and condenses the living fibre; and it is in part by this action exerted on the circular fibres of the blood vessels, into which it enters, that it operates in checking passive hæmorrhages: at the same time we must allow that its tonic influence on the stomach is extended to the whole habit; but this tonic influence alone would be scarcely adequate to produce its astringent effect. There is no foundation for the opinion of Boerhaave, that this diluted acid coagulates the fluids when taken into the system.

Diluted sulphuric acid is prescribed in both active and passive hæmorrhages. In the former it is given more largely diluted, and is supposed to act chiefly as a refrigerant; thus, by lessening febrile excitement, allaying thirst, and of course diminishing vascular action, it gives time for the formation of a clot on the orifice of the bleeding vessel: in the latter, it acts solely by its tonic and astringent power. When combined with mucilage of acacia gum, it has been beneficially given in passive diarrhœas, which it checks by operating on the relaxed mucous coat of the intestine as an Astringent. In some individuals, however, it has an opposite effect in every state of the system, producing violent gripings and purging; but this effect may be moderated by the addition of aromatics and of opium. In using opium, it must be recollected that this acid, by uniting with the morphia, renders the opium more powerful as an anodyne. As a gargle, in combination with infusion of roses, this acid is a useful Astringent in relaxation of the uvula and fauces, and to check salivation. As it is injurious to the teeth, when given in large doses, it should be sucked through a quill.

It might be supposed that it could not, with propriety, be combined with some of the vegetable Astringents, for instance, Kino and Catechu; but in the degree of dilution in which it is employed as a medicinal agent, there is no objection to such a combination.

2. Acetic Acid. *Acetic Acid.* L. E. D.—This Acid, in its pure and highly concentrated state, is colourless, limpid as water, highly volatile, exhaling a pungent agreeable odour, and so acrid that it cannot be tasted: even when applied to the skin, it inflames and blisters the part. When it is much

concentrated, it takes fire at a high temperature in the open air. The sp. gr. of the most highly concentrated that can be procured is 1.063; but it is rarely obtained of a greater strength than that which indicates a sp. gr. 1.043. In this state it consists of 23.67 of anhydrous Acetic Acid + 76.33 of water in 100 parts. It crystallizes when cooled down to a temperature of 28° Faht., and remains solid until the temperature rises to 50°; but it melts again and remains fluid at 40° Faht., unless a crystal of the acid be thrown into the fluid, when crystals instantly dart out from it on all sides, and the whole assumes the solid form. It crystallizes, also, beautifully under a compression of 1100 atmospheres. The composition of the anhydrous acid, which exists only in dry acetates, is

2 prop. of Hydrogen $(1 \times 2) = 2$, + 4 of Carbon $(6 \times 4) = 24$, + 3 Oxygen $(8 \times 3) = 24$. Equivalent 50.

Acetic Acid can only be procured from the dry acetates, or by employing charcoal. If the acetate of soda be employed, it is to be decomposed by sulphuric acid; and the whole being put into a retort, it must be distilled. The acid thus procured readily crystallizes. When it is to be obtained by means of charcoal, according to the process invented by Lowitz, the charcoal must be first put into a crucible, and, a cover being fitted, it must be brought to a red heat. When cold, it is to be mixed with common vinegar, to the consistence of a paste, and distilled by a gradually raised fire. At first an acidulated water comes over, which must be rejected; after which the joints of the apparatus must be well luted and the heat increased; the acid now comes over in a concentrated state, and even in a crystalline form.

Strong Acetic Acid oxidizes iron, zinc, copper, nickel and tin; it readily combines with all the metallic oxides and also with the alkaloids, forming acetates. It dissolves resins and gum resins, camphor, and volatile oils; and, when mixed with alcohol and aided by heat, it forms an ether, which is named acetic ether. During its union with water, heat is evolved.

In its concentrated state, Acetic Acid cannot be given internally, without acting as a virulent poison; when it has been

taken into the stomach, the best antidote is magnesia. The after-treatment should be the same as that for inflammation of the stomach.

To render pure Acetic Acid useful as an Astringent, it must be diluted with water, in the proportion of five parts of the acid and ninety-five of water. But diluted Acetic Acid, for medicinal purposes, is procured by the distillation of common vinegar. The best vinegar is made from wine not more than a year old. At Orleans, where the best white-wine vinegar is made, the wine is kept for some time in casks with beech shavings, which clarifies it. The wine, thus clarified, is then boiled, and poured into casks, in quantity sufficient to fill one third of each cask, and left for eight days ; after which two gallons and a half of wine are added every eighth day, until the casks are two thirds filled. Eight days after this time the vinegar is fit for use ; but a portion only is drawn off, and fresh wine is added to keep up the contents of the barrel to two thirds of its capacity. The casks are exposed to the atmospheric temperature only in summer; but in winter a temperature of 75° Faht. is maintained by means of stoves. In Holland and some other parts, the acetous fermentation of the wine is aided by having double-bottomed barrels, the inner bottom being pierced with holes. On this grating the leaves of the vine and the footstalks of grapes are spread. Every twenty-four hours, the half-full barrel is to be filled from the full one, so as to keep one of these barrels always full and the other half full. The fermentation proceeds most briskly in the half-filled barrel, and in fifteen days the vinegar is made. In this country the greater part of the vinegar is made from malt; but sugar and water, or any vegetable matter containing a saccharine principle, is sufficient.

The theory of the acetous fermentation is not so well understood as that of the vinous fermentation. When wine or any alcoholic fluid is employed, no acetous fermentation will take place, unless the liquor be exposed to the air and to a temperature between 65° and 80° Faht. : it is very evident that the affinities between the constituents of the alcohol and the other ingredients are broken, and new combinations

formed; whilst carbon is given off, and the oxygen of the air, uniting with it, forms carbonic acid gas, although not in great quantity. When the conversion into vinegar takes place in close vessels, the quantity of carbonic acid formed exactly compensates the quantity of oxygen which has disappeared in the process. During the process, also, all the malic acid originally contained in the wine has disappeared, as well as the alcohol, and the glutinous matter of the wine undergoes some change. The difference of the ultimate constituents of alcohol and vinegar consists in the greater relative proportions of oxygen to the carbon, and the smaller proportion of hydrogen in the vinegar than in the alcohol. The quantity of vinegar obtained is precisely proportional to the quantity of alcohol contained in the wine employed. Difficulties have been supposed to arise from the fact, that Acetic Acid is produced without the vinous fermentation having previously existed, as in making starch, and when gluten of wheat is fermented with sugar and water. Acetic Acid is also extricated when sulphuric acid is poured on some vegetable bodies, and in large quantity, when wood free from turpentine is distilled in close vessels.

Vinegar procured from wine or from malt is a fluid of an agreeable, penetrating odour, and a pleasant acid taste, varying in colour from a pale straw-yellow to a deep brownish red. It generally contains, besides Acetic Acid, a little undecomposed alcohol, mucilage, colouring matter, some sulphuric acid, which is added to it by the manufacturers, and water. In this state, vinegar is used as a condiment, but it requires to be distilled for the purposes of medicine; by which process, performed according to the formula in the Pharmacopœias, five fluid pints only are procured from a gallon of vinegar. The first pint is rejected as too weak; the remaining two contain much Acetic Acid, saturated with carbonaceous matters, and so much bitartrate of potassa as to render it unfit for use. Much distilled vinegar is procured from the distillation of wood*. An impure, dark-coloured

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* Pyrolignous acid, mixed with water, in the proportion of two fluid ounces to four of the water, is nearly the same as distilled vinegar of 1009 specific gravity.

acid, containing tar and an empyreumatic oil, is first procured: this is mixed with lime, which takes up the Acetic Acid and leaves the tar and oil; an acetate of soda is formed by decomposing this acetate of lime with sulphate of soda, and is purified by fusion in a high temperature insufficient to decompose the salt. The acetate of soda is lastly decomposed by sulphuric acid, which sets free the Acetic Acid.

Distilled vinegar has a less agreeable odour than common vinegar: the taste is also less pungent. It is limpid and colourless like water; but contains some mucilage and extractive; independent of which, it is merely Acetic Acid largely diluted with water. At a sp. gr. of 1.007, distilled vinegar contains Acetic Acid 3.42, + water 96-58, = 100, and should dissolve 13.8 grains of white marble.

Distilled vinegar is often adulterated. Nitrate of silver detects muriatic acid by affording a precipitate insoluble in any acid. If it contain copper, ammonia or the ferrocyanate of potassa detects it. Solution of perchloride of gold will discover the tin, by forming the purple colour of Cassius; and sulphuretted hydrogen the presence of lead, by the deep brown precipitate which it throws down. On account of these impurities, vinegar should always be distilled in a glass retort.

As a remedial agent, diluted Acetic Acid is a useful and agreeable Astringent; and produces a tonic effect, whilst at the same time it is refrigerant: on this account it has been given with advantage in phthisis pulmonalis; and it is still more valuable in this disease when hæmorrhage occurs, particularly conjoined with acetate of lead, or taken at the same time with that salt. This acid, largely diluted, was employed as a refrigerant in phthisis so early as the time of Galen, and it is still employed for the same purpose by the oriental physicians. But it has been lately used, in its less diluted state, and in larger quantity, to obtain its astringent influence. M. Orban, who witnessed its use at Tunis, says that the quantity taken daily was seven fluid ounces diluted with forty-nine fluid ounces of rain-water; pills consisting of small doses of alum and sulphate of iron being taken at the same

time. The Moorish physician gave no favourable opinion of the effects of the acid, until it produced a costive state of the bowels, when he spoke with confidence of a cure being effected. This fact is too little attended to in the treatment of phthisis: the disease appears arrested when the bowels are confined; the cough becomes less irritable, and the strength of the patient is maintained. M. Orban left the patient convalescent. He employed the same plan with considerable success in France. The only British practitioner who has recorded the result of his experience of the use of Acetic Acid in phthisis is Dr. Roberts, in whose hands the success of the practice was considerable*. It operates by restraining hæmoptysis, checking the hectic and morning sweats, and producing costiveness. Indeed, when we consider the nature of the disease, the debility that attends it, and its connection with the scrophulous diathesis, there is little doubt that the acid operates as a tonic astringent. It exerts also a powerful action on the absorbents; as the use of vinegar by young females, who wish to reduce themselves from a state of corpulency, has too frequently demonstrated. None of the cases in which I have employed it recovered; but all of them seemed to be benefited, as far as a mitigation of symptoms, by its use. It diminishes action, checks night sweats, restrains hæmoptysis and diarrhœa. It may be administered in conjunction with infusion of calumba or of cascarilla. The external use of this acid has not been confined to phthisis; but it has of late been much employed in ordinary cases of debility, diluted in the proportion of one part of strong vinegar and five of water, for sponging the trunk of the body before the patient gets out of bed in the morning. In these cases, its beneficial effects cannot be referred either to its sedative or refrigerant properties, but to its stimulant and astringent powers.

As an Astringent, vinegar has been administered internally, in combination with salt, in dysentery: it not only checks the purging, but corrects the fœtor of the stools. As a local Astringent, it has long been employed in relaxations of the uvula and fauces in the form of gargles, especially in

* Med. Trans. of the College of Physician, vol. v.

those cases of ulceration, attended with sloughing of the tonsils, such as occur in scarlatina and malignant or putrid sore throat. In such cases, however, it is not so frequently employed now as formerly, the aqueous solution of chlorine having been found more useful.

In the form of collyria, vinegar has been long and successfully used as a gentle Astringent in ophthalmic inflammation, and as a lotion in fœtid ulcers. As a local application, it has also been found useful in hæmorrhages: it favours the retraction of the bleeding vessels and the formation of a clot. This effect, however, must not be confounded with that caused by the application of vinegar and water to the abdomen and thighs in uterine hæmorrhages, in which the acid acts as a refrigerant by aiding the evaporation of the water.

d. Metallic Salts.

1. ALUM. *Sulphate of Alumina and of Potassa.* L. E. D. —Alum is a salt, which was known to the ancients as a mordaunt in dying; but its nature was not understood till 1754, when Margraff detected a peculiar earth as one of its essential constituents. Margraff named this earth *Argil*, but Morveau afterwards gave it the name which it now bears, *Alumina.*

Alum is found ready prepared by the hand of Nature, in some places, as at Götturg, in Austria, and at the Solfatara, a concealed volcano near Naples ; but the greater part of the Alum of commerce is prepared from aluminous pyrites or schistus, which is roasted and exposed to the action of the air and the moisture of the atmosphere: the sulphuret of iron, which is present in the schistus, is oxidized by attracting the oxygen of the air and that of the decomposed moisture; and, its sulphur being thus converted into sulphuric acid, it combines with the Alumina, forming an alluminous efflorescence. This is separated by lixiviation, and the solution concentrated, until it acquire the sp. gr. 1.35, when some salt containing potassa is added. This addition, however, is not always necessary, as the schistus sometimes contains potassa. The solution being boiled and run into coolers, crystallizes; but it undergoes a second crystallization after running off the

mother water of the first; and as this takes place in casks, in which the salt forms into a solid mass, the operation is termed *roching*, and the Alum thus crystallized Roch Alum. The interior of the mass is generally in large regular octahedrons*.

There are various kinds of Alum. The Roman, which is very pure, is in irregular masses, covered with pink powder on the surface. The Levant, which is in small pieces also, of a pinkish or pale rose colour; and the English, which is in large masses. The English Alum, generally, slightly effloresces in the air; in a moderate heat, it fuses, and losing its water of crystallization, becomes opaque, and acquires a corrosive property when applied to the body: it is then termed *burnt* or *calcined Alum*. All the varieties of Alum are soluble in five times their weight of water at 60°, and in their own weight of boiling water. The solution generally reddens vegetable blues; and is decomposed by the alkalies, which, uniting with the acid, precipitates the alumina. If the Alum contain iron, which is frequently the case, it is detected by first adding a little nitric acid to the heated solution, and then precipitating by ammonia, which renders the peroxide visible, of a yellowish-green changing to a red colour. Alum is precipitated, also, from its solution, by many infusions that contain extractive and tannin; consequently, by infusions of many astringent vegetables; by all the salts containing bases which unite with sulphuric acid; for instance, lime and magnesia, the carbonates of the alkalies, ammonia, and the muriate of ammonia, tartrate of potassa, the acetates of lead, and the greater number of the metallic salts, which are, consequently, incompatible in prescriptions with Alum. But it may be

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* There are several Alum mines in Great Britain: for instance, at Hurlett, near Paisley, where the aluminous slate lies above coal; and at Whitby, where it is disposed in strata, nearly upwards of one hundred feet in depth and twenty-nine miles in breadth. On an average, one hundred and fifty tons of slate produce one ton of Alum

The calcined salt is washed with four successive waters, and, when it acquires a sp. gr. of 1.45, kelp ley of a sp. gr. 1.025 is added to it: but the best Alum is made by the addition of soap-boilers' ley, which contains a muriate of iron, that does not crystallize with the Alum.

combined with the chloride of mercury, and all the metallic sulphates. According to Mr. Phillips, Alum contains—sulph. ac. 32.86, + alumina 11.08, + potassa 9.86, + water 46.20, = 100: or 4 prop. sulph. ac. (40 × 4) = 160, + 2 alumina (27 × 2) = 54, + 1 pot. = 48, + 25 water (9 × 25) = 225, equivalent 487. This differs from Vauquelin's analysis, which is suplh. ac. 30.52, + alumina 10.50, + potassa 10.40, + water 48.58, = 100.

As a remedial agent, Alum is employed, in cases requiring the use of Astringents, both generally and locally. When taken into the stomach it causes, often, a disagreeable and painful sensation at the epigastrium; and, if the dose be large, nausea, vomiting, colic, and purging; but, in small doses, constipation. When taken into the circulation, Alum is stated to irritate the lungs and provoke coughing*; but my experience has not confirmed this remark. It is employed, generally, in internal hæmorrhages; in chronic diarrhœa; in leucorrhœa; and it is recommended by some physicians in diabetes. It must, however, be recollected, that in old diarrhœas, when ulceration of the mucous membrane exists, Alum may be productive of mischief. In confluent small pox, when the pustules are livid and filled with a bloody serum, Alum whey, prepared by boiling ʒii of Alum in a pint of milk, has been administered with much benefit.

Although Alum cannot be combined with the infusions and decoctions of astringent vegetables, yet it may be combined with opium and with aromatics, which correct its tendency to disturb the bowels—a circumstance connected with its action which sometimes proves detrimental in cases of uterine hæmorrhage, in which it generally operates beneficially. It was first given in this disease by Van Helmont; and the opinion of Cullen, in its favour, adds considerable weight to Helmont's recommendation. It is not easy to explain how it operates on the uterine vessels through the stomach, unless we admit that it is taken into the circulation. In pyrosis, Alum has been recommended as an adjunct to opium; but I am of opinion that a sedative, rather than an Astringent, is

* Traité Elémentaire de Mat. Med. par J. B. C. Barbier, 3d. edit. t. i, p. 521.

required in this painful affection; and that the benefit in this case is due to the opium.

As a local Astringent, Alum is useful in relaxations of the uvula, and in aphthæ; and no injection proves more useful than its aqueous solution in leucorrhœa and gleet. In chronic inflammation of the eye, it forms a good collyrium; and, in this case, the facility of uniting it with sulphate of zinc is a great advantage. In ecchymosis of the eye, the cause of which is not always obvious, a very useful mode of applying it is in the form of coagulum, made by agitating a lump of Alum in white of egg. The acid coagulates the albumen, whilst the serous or watery part dissolves a certain portion of the Alum; and an excellent vehicle is thus formed for its application.

The dose of Alum for internal use is from gr. v to ℈ii; for external use, the strength of the solution may depend on circumstances.

Although an Astringent, Alum has been justly vaunted as a remedy in colica pictonum. In this case, much of the benefit produced, if the remedy be early administered, is due to its chemical influence in converting the carbonate of lead, which has produced the mischief, into the sulphate, which is innocuous. Its further influence, as a stimulating astringent, may prove useful in counteracting the paralysis of the intestinal nerves, and mitigating the pain. Dr. Percival recommended fifteen grains to be given every third, fourth, or fifth hour; and, as far as his experience went, he affirms that its use was followed with unvarying success.

2. Sulphate of Iron. L. E. D.—Muriate of Iron. —The styptic nature of the salts of iron is well demonstrated by their external application: but it is only in states of great debility, and in hæmorrhages occurring in such states — for example, in scurvy and purpura — that they can with propriety be internally administered; so that they are seldom employed as general Astringents. When it is essential to employ them, they should be given, at first, in small doses, and gradually augmented. They enter the circulation slowly; but, after some time, excite a febrile action in the whole system, cephalalgia, with weight in the head, and

tingling in the skin. As a local application, the Muriate, or hydrochlorate, in the form of tincture, largely diluted with water, is frequently used for touching cancerous and fungoid ulcers.

3. Sulphate of Copper. L. E. D.—This salt has been given with great advantage in obstinate chronic diarrhœa, in doses of from one sixth to half a grain, combined with opium. I can say little of its value in this complaint from my own experience, having seldom prescribed it: it undoubtedly proved useful, and its effects have verified the accounts of its powers which Dr. Elliotson has published. Its astringent influence cannot be questioned: but, at all times, the salts of copper are hazardous when introduced into the stomach; and, therefore, I am not anxious to recommend this sulphate to notice, even in similar cases to those noticed by Dr. Elliotson, until all other means fail. If it be given, and headache, vomiting, and pains of the bowels, with cramps in the legs supervene, its use should be instantly discontinued, and a solution of the albumen ovi, combined with sugar, should be freely exhibited, giving at the same time, from m. x. to xv of the ferro-cyanate of potassa in water. As an external Astringent, it is less exceptionable; and, in the proportion of gr. i in f℥i of rose water, is an excellent injection in incipient gonorrhœa, producing a new and more healthy action in the inflamed membrane, and apparently operating also, chemically, on the virus, as it prevents the discharge from making its appearance. It should be employed on the first appearance of the symptoms, and continued twice a day, for a short time, after they have disappeared.

Copper, in its oxidized state, and particularly when combined with acids, proves fatal when applied to wounds in dogs and some other quadrupeds: but sulphate of copper is daily applied to ulcers in the human body with impunity, except in peculiar idiosyncracies.

4. Sulphate of Zinc. L. E. D.—The salts of Zinc, although frequently given as tonics, yet are seldom administered with the view of obtaining astringent effects, except as external applications. In the form of collyria, or as lotions, the sulphate and the acetate of Zinc are employed in ophthalmia and other inflammatory affections, after the excitement

has been partially subdued by local blood-letting and other depleting means. There is one case on record, quoted by Dr. Christison from Pyl's Memoirs, of the external application of Sulphate of Zinc proving fatal: it was applied to cure a scabby eruption on the head, and had not been long used before the child, who was six years old and healthy, complained of acute burning pain of the head, which was followed by vomiting, purging, convulsions, and death in five hours. As I have not seen Pyl's account of the case, and Dr. Christison's quotation contains little detail, I can form no opinion of the cause of this uncommon effect of the external use of the sulphate. It may have been owing to idiosyncracy; or the fatal effects may have originated from metastasis, by the repulsion of the eruption causing meningitis or inflammation of the membranes of the brain—an effect of local applications in Porrigo, which I have witnessed more than once.

A large dose of these salts of Zinc produces little effect on the habit, as they are constantly rejected by vomiting; but, should an overdose, to a less extent, produce pains of the stomach and bowels, retchings, and diarrhœa, these effects are best counteracted by carbonate of potassa and oleaginous mixtures.

5. Nitrate of Silver. L. E. D.—This salt is a powerful tonic when taken into the stomach; but it has never been administered internally as an Astringent. It has been successfully employed, externally, in ophthalmia; but, as the smallest portion of animal matter instantly discolours the solution in distilled water, and leaves a permanent stain on the skin, the eye-lids should be touched with oil before dropping the solution into the eye. In ulceration of the cornea, and in obstinate inflammation of the conjunctiva, gr. ii of the nitrate in f℥i of distilled water, is of sufficient strength: but, when the ulcers are of a nature to threaten protrusion of the iris, the proportion of the nitrate should be ten grains to the fluid ounce of water: and the same degree of strength of solution is requisite in inflammation forming granulations of the palpebræ, and in ophthalmia from gonorrhœa. In these cases a drop or two of oil of sweet almonds should be dropped into the eye immediately after the solution has been

applied. The best mode of introducing both the nitrate and the oil, is to take them up with a hair pencil and to introduce its point at the angle of the eye. The fluid leaves the pencil, and immediately spreads itself over the ball of the eye, and the inside of the lids.

B.—ASTRINGENTS WHICH EXERT A SEDATIVE INFLUENCE ON THE SYSTEM.

e. Metallic Salts.

1. CARBONATE OF LEAD, *Plumbi Subcarbonas.* L. *Carbonas Plumbi,—Cerussa.* E. D.—When metallic lead is exposed to the air, it soon acquires upon its surface a thin white coating, which is a carbonate of the metal: when lead is exposed to the combined action of distilled or rain-water and air, a white insoluble powder forms, which is also a carbonate of lead: rain-water, collected from the roofs of the houses newly furnished with leaden spouts, or eave-droppings from lately erected leaden roofs, water agitated in leaden cisterns at sea, and many other conjunctions of lead and *pure* water, produce Carbonate of Lead; it is also formed when the acetate and subacetate of lead in solution are exposed to the air, or when hard water or solutions of salts, containing carbonates of alkalies, are mixed with them.

Carbonate of Lead also occurs native; but that employed in medicine is procured by exposing plates or coils of lead in pots, furnished with a ledge, on which the coil rests, to the action of the vapour of vinegar, and, at the same time, to that of carbonic acid, by placing these pots in fresh stable-litter. The vinegar oxidizes the surface of the lead, and converts the oxide into a subacetate of lead, which is again rapidly decomposed, and formed into the Carbonate by the carbonic acid, extricated from the fermentation of the stable-litter. The Carbonate is then detached from the surface of the lead, ground in water, and afterwards dried in stoves, heated by means of flues.*

Carbonate of Lead is a white, heavy, inodorous, insipid powder, insoluble in water; very soluble in nitric acid and strong acetic acid; and partially soluble in a concentrated so-

* London Dispensatory, art. Plumbi subcarbonas.

lution of pure potassa. According to the analysis of Berzelius, it consists of

Protoxide of lead	1 prop. =	112	or	83.5
Carbonic acid	1 prop. =	22		16.5
	Equivalent	134		100.0

It is easily reduced to metallic lead by exposing it on charcoal to the action of the blowpipe; and is converted into the sulphuret by exposure to sulphuretted hydrogen gas, or its aqueous solution. When adulterated with chalk, which is sometimes the case, the chalk can be easily detected by putting the suspected Carbonate into distilled vinegar, filtering and testing the fluid with oxalate of ammonia. If chalk be present, an insoluble oxalate of lime will be precipitated.

This Carbonate is a powerful sedative Astringent; but it is never internally administered, on account of its poisonous properties. It even requires to be applied with caution to abraded surfaces: it is frequently employed to prevent excoriations in the joints of heavy, fat children.

This is the preparation of lead from which colica pictonum, painters' colic, in every instance arises. The symptoms it produces, when taken into or formed in the stomach, are, at first, not unlike those of common dyspepsia: soon afterwards, obstinate costiveness, violent pain and tormina, or a sensation of twisting at the naval, supervene; the stomach becomes very irritable and rejects the food by vomiting; violent gripings succeed, which are temporarily relieved by pressure; the muscles of the abdomen are powerfully retracted, and the umbilicus drawn inwards. In general there is obstinate costiveness, but sometimes diarrhœa occurs; the urine is diminished in quantity; the saliva assumes a bluish colour; and the expression of the countenance becomes dull, anxious, and gloomy. Along with these symptoms, the pulse is small but hard; the respiration laborious; and, if relief be not soon obtained, the attack terminates either fatally or in paralysis of the extremities. The immediate cause of the fatal termination is not unfrequently nervous apoplexy; but the most common is palsy. This attacks, at fisrt, only the fingers, sometimes the whole hands, and then the lower extremities. Palsy sometimes occurs simultaneously in the

colic, although it is seldom noticed until the pain abates. In the hands, the extensors of the thumb, and those of the fore and the little finger, are most affected; the flexion of the wrist is a very characteristic symptom; the arms cannot be raised, but hang dangling at the sides. When paraplegia supervenes, the patient complains of excruciating pains in the limbs.

The best remedy when colic only is present, is castor oil combined with opium; and, when there is reason to suspect that a portion of the Carbonate still remains in the stomach, the sulphates of magnesia and of soda should be administered. These salts are decomposed by the Carbonate of Lead, an inert sulphate of lead is formed, and this is carried through the bowels by the undecomposed portion of the purgative salt. On the same principle, alum, the sulphate of alumina and potassa, is also useful in colica pictonum.

When paralysis of the extremities occur, the remedies are the extract of nux vomica or strychnia, in the form of an acetate, and the application of the galvanic influence. The dose of the acetate of strychnia should not, at first, exceed $\frac{1}{10}$ of a grain; and its augmentation should be very gradual, until tetanic twitchings appear.

2. ACETATE OF LEAD. *Plumbi Acetas—superacetas.* L. E. D.—According to the Pharmacopœia of the London College, this salt is prepared from the carbonate of lead and acetic acid. But the salt, even for medicinal purposes, is manufactured in the large way in Holland, and also in England. In England, litharge is acted upon by pyrolignous acid, of a sp. gr. 8 of Beaumé. The Acetate, however, which is thus prepared, often contains copper and other impurities, and ought not to be employed in medicine. When pure, this Acetate is inodorous, and has an astringent sweetish taste. It is generally in the form of small, glossy, needle-shaped crystals, which, when narrowly examined, are flat, quadrilateral prisms, terminated by dihedral summits: when carefully crystallized, the crystals are large. Its sp. gr. is 2.345: it dissolves in 25 parts of distilled water; but, on being kept in solution, a white powder falls, which is carbonate of lead, formed from the union of the oxide of the acetate with the carbonic acid, attracted from the air; this is

rendered evident by blowing through a clear solution of the Acetate;—the carbonate is formed; and this is also the case when pump or hard water is employed in making the solution. The solution of the acetate is also decomposed by all the acids which form insoluble salts with the oxide of lead, the sulphuric, muriatic, carbonic, oxalic, and tartaric; by lime water and all the alkalies; but pure potassa and soda, if added in excess, redissolve the precipitates. Sulphuretted hydrogen precipitates it in the form of the black sulphuret. It is also precipitated by infusion of galls, and all astringent vegetable decoctions and infusions; and almost all animal fluids, with the exception of gelatin.

The components of this acetate are

Acetic Acid......	26.45	1 prop.	=	50
Oxide of Lead	59.25	1 prop.	=	112
Water............	14.30	3 prop. (9×3)	=	27
	100.00	Equivalent		189

As a sedative Astringent, this salt is a valuable medicine, and one which may be given with much greater safety than is generally supposed. It acts directly upon the nerves of the stomach as a sedative, and its action is gradually extended to the entire system. After its employment has been continued for some days, the pulse falls in frequency and force; and, if the dose be too rapidly increased or be too large, pains of the stomach, nausea, a diminished secretion of high-coloured urine, turgidity of the gums, constriction of the throat, and vertigo, supervene. When these symptoms occur, the use of the acetate should be immediately suspended. The writings of Sir George Baker and of Dr. Heberden did much to confirm the bad repute of this salt of lead; but subsequent experience has demonstrated that it may be administered, not only with safety, but with the greatest benefit, in all cases of active hæmorrhage. I have given it in doses of five grains, and occasionally in larger doses, washing them down with diluted distilled vinegar, for several successive weeks, without perceiving the smallest deleterious result from its employment. This mode of administering the Acetate of Lead was suggested by me from having ascertained that the only direct poison of lead is the *carbonate*, and that acetic acid checks

the formation of that salt from the decomposition of the acetate in the intestines. Mr. Laidlaw, a surgeon, who made a series of experiments on himself with this Acetate, without using vinegar, took it in the solid form to the amount of gr. xii in twenty-four hours, for several successive days, without producing colica pictonum. When griping pains occurred, they were speedily allayed by increasing the proportion of the opium in the pills. Mr. Laidlaw took it also in the fluid form, in smaller doses, until gr. lxx were taken, without any deleterious result. One curious result of its continued use was the excitement of ptyalism.

The general effect of the internal administration of this salt, in moderate doses, is certainly sedative, and locally astringent. The fauces and pharynx are constringed in swallowing it. Its employment in hæmorrhages is of very ancient date ; and it has been advantageously used, whatever may be the organ or part of the body in which the hæmorrhage appears. Dr. Latham introduced the use of this acetate in collequative diarrhœa, and in tubercular consumption, attended with ulceration ; and, although I cannot say that my experience has induced me to place any confidence in it as a remedy for phthisis, yet, it certainly lessens the irritability and corrects the tendency to diarrhœa which usually accompany that intractable disease.

In prescribing this salt of lead, and all the other salts of this metal, we must keep in view the influence of idiosyncracy in modifying the operation of medicines; as some individuals are peculiarly susceptible of impressions of the most hurtful kind from the smallest doses of the salts of lead. When it happens that it proves hurtful, it may be detected by several reagents: thus, it is precipitated white, as a carbonate, by the carbonates and the sulphates of soda or of potassa; bright yellow by hydriodate of potassa, which forms an iodide of lead ; and black by the solution of sulphuretted hydrogen, forming a sulphuret of the metal. If the precipitate by any of these reagents be mixed with charcoal and submitted to the blowpipe, a button or globules of metallic lead will be procured.

As an external application, the acetate has been most extensively employed in collyria and lotions in all cases requiring the aid of local astringents. The dread of its deleterious properties was at one time even extended to its external employment; but the fallacy of the opinion has been undeniably demonstrated. It must be admitted, however, that instances have occurred in which the bowels have been affected even by the external application of the acetate: thus, in a case mentioned by Dr. Wall, in the first volume of the Transactions of the College of Physicians, colic was produced by immersing the legs twice a day, for ten days, in a bath of the solution of Acetate of Lead.

Acetate of Lead may be given in doses of from gr. iii to gr. vi, combined with a quarter or half a grain of opium, and made into pills with the crumb of bread. In hæmorrhagic diseases, where its sedative or astringent effects are rapidly required, the solution should be preferred; but in this case it should be given in combination with distilled vinegar. When pills are preferred, the action of the acetate is augmented by the use of distilled vinegar, largely diluted, as ordinary beverage.

Notwithstanding its effect in producing ptyalism, it has been recommended, by Mr. Daniels, to be given for the purpose of allaying violent salivation, in doses of gr. x to ℈i, in conjunction with gr. x of the compound powder of ipecacuanha. How are these contending opinions to be reconciled? In making the collyria and lotions, unless the water be very pure, the carbonate is invariably formed; but this may be prevented by adding a little distilled vinegar.

3. *Subacetate of Lead. Plumbi Subacetatis Liquor.* D.—This salt is formed by boiling 100 parts of the acetate and 150 of litharge deprived of carbonic acid, and crystallizing. For medicinal purposes, however, it is generally prepared in a fluid form, by boiling litharge in diluted acetic acid until the mixture be concentrated more than one half. The filtered liquor, after the dregs have subsided, is the Liquor Plumbi Acetatis of the London Pharmacopœia. According to the analysis of Dr. Bostock, it is a solution of a subacetate, which consists of

Oxide of Lead	81.75	or 2 prop.	(112×2) =	224
Acetic Acid	18.25	1 prop.	=	50
	100.00		Equivalent	274

When prepared with common vinegar, it has a greenish-yellow colour; but if the acid be pure, it is colourless. It has a sweetish astringent taste; and, when prepared with vinegar of a sp. gr. 1.007, the solution of the subacetate should have a sp. gr. 1.220. It is decomposed by the smallest quantity of carbonic acid contained in any water with which it is mixed. Even exposure to the air converts it rapidly into the carbonate, and a few bubbles of breath thrown into it produces the same effect. It is distinguished from the acetate chiefly by its precipitation of a solution of gum, for which it is a very delicate test. It is affected by the same reagents as the acetate. It is employed, in a diluted state, as an external astringent, in phlegmonous inflammation and scalds.

The Subacetate of Lead is never internally administered, and is the preparation of this metal, next to the carbonate, which is most poisonous; but this property depends on its conversion into the carbonate which occurs in the stomach. I have seen more than one instance of death resulting from a large dose of the Subacetate of Lead having been taken by mistake. It induces colica pictonum; the appetite becomes impaired, whilst nausea, and a discharge of saliva resembling ptyalism, supervene, accompanied with great restlessness. There is often bilious vomiting, during which the colic pains come on and recur at intervals, affecting chiefly the umbilical and iliac regions, the parietes of the abdomen feeling knotted and being drawn inwards: there is also obstinate costiveness. Headache, pains of the limbs, particularly of the ankles and soles of the feet, are now felt: there is generally no fever; but the expression of the countenance is indicative of the greatest distress; the cerebral functions become disturbed, and the patient sinks. The immediate cause of the fatal termination is apoplexy, of that description which has been termed nervous; the more common termination, however, is in palsy. This attacks first only the fingers, sometimes the whole hands, and then the lower extremities. The palsy

occasionally occurs at the same time as the colic; but is seldom noticed until the pain abates. When it affects the hands, it is the extensors of the thumb and fore and little finger that are most affected; the flexion at the wrist is very characteristic of the disease; and the arms cannot be raised, but hang dangling at the sides. When paraplegia supervenes, the patient complains of excruciating pains in the limbs. It is evident that the poison of lead acts on the vascular system as a powerful sedative, or rather it acts as a sedative on the motor nerves; for the pains which are felt demonstrate that its operation, if it exert any on the nerves of sensation, is not that of a sedative.

The only disease which is caused by the poison of lead is colica pictonum; and in almost every writer upon the subject it is stated that this colic is the result of lead taken into the habit, in whatever form it may be introduced. Litharge is stated to be a poison; because wines, in which it has been put to overcome acidity, have produced colica pictonum. In the writings of Sir George Baker and others instances are related of that disease having arisen from the prolonged use of the Acetate of Lead; and cases are detailed in which its external application has produced similar effects. Dr. Wall has given two cases, in which this colic could be unequivocally traced to the application of *Goulard's* extract, to open ulcers; and one in which it was produced by immersing the legs in a bath of the acetate. Now, although I do not deny the accuracy of any of these facts, and admit that colica pictonum may result as a sequence to the use of any oxide or any salt of lead, yet, I trust that I shall be able to prove that whatever may be the form in which the lead exists, when taken into the stomach or applied to the surface, still that it is one only of the salts of lead, the *carbonate*, which is really adequate to the production of colica pictonum.

To prove this point, in the first place let us enquire what are the occupations of those persons most liable to this disease. It will be found that miners, who dig the ore and the sulphuret, who must necessarily inhale some of the dust of these states of lead and take it into their stomachs, are not liable to colica pictonum; whilst those workmen who smelt

the lead frequently suffer. It would not be a difficult task to prove that the fine exhalation of oxide of lead, formed in smelting, inhaled into the lungs, is rapidly converted into carbonate of lead when exposed to the carbonic acid of the pulmonary tubes, in combination with their heat and moisture. Next to smelters of lead, we find that manufacturers of sheet lead, plumbers, glaziers, painters, and compositors in printing offices, are most liable to colica pictonum. It is scarcely requisite to say that it is with white lead or the carbonate that these tradesmen, except the compositors, are occupied; and that it is most commonly conveyed into their stomachs with their food, owing to their uncleanly habits of taking their food without washing their hands. The compositors are not affected with colica pictonum, but with partial paralysis; and I have heard of an instance of a man, who was in the daily custom of handling pigs of lead and loading carts with them, having twice suffered with this disease. Now, I have already mentioned that the whitish efflorescences collected on the surface of metallic lead exposed to the air is carbonate of lead; and it might not be difficult to trace this into the stomachs of those who are constantly handling lead, or to trace it into that organ in painters; but it is more probable that it acts locally on the cutaneous nerves, as compositors are merely affected with palsy in the hands. Of all artisans, however, who work in lead, the manufacturers of white lead are the most liable to colica pictonum. This was particularly the case when the grinding of the white lead was performed in the air; the grinding houses were generally full of dust of Carbonate of Lead, and the men, consequently, received it into the lungs and into the stomach. For many years I had the medical management of a very large white lead manufactory on Thames' bank, and, before the process of grinding the white lead under water was adopted, I had frequently to prescribe for two or three of the workmen labouring under colica pictonum: but after the use of water, in the grinding part of the process, was adopted, very few cases indeed of the disease occurred. In every instance in which white lead has found its way into the stomach, colica pictonum has followed; whereas the acetate, as I have already

stated, has been taken in large doses, and for a long period, without any injurious consequences. There is, therefore, undoubtedly sufficient reason for affirming that carbonate of lead is the most poisonous of the salt of lead; but I have made good my assertion that it is actually the only poison among the salts of lead, by a series of experiments on rabbits*.

The question next occurs, in what manner is the lead which is taken into the stomach in wine, cyder, and other means rendered poisonous, if the carbonate only operate as a direct poison? I reply, that these liquors, when rendered poisonous by admixture with litharge or with sugar of lead, contain the poison in the form of the citrate, which is converted into the protoxide by being reduced by the animal juices of the stomach, and that the attraction of this oxide for carbonic acid is so great that it is rapidly converted into the carbonate:—and in this state it acts upon the nerves of the intestinal canal and its muscular coat, producing the disease in question. If we trace the history of the cases of poisoning by salts of lead, we shall find that the danger is in the direct ratio of the facility with which the conversion of the salt of lead that is swallowed into the carbonate takes place. It is on this account that the subacetate is so much more poisonous than the acetate; for, next to the carbonate, it is the most poisonous of the salts of lead. The greater facility of converting it into the carbonate can readily be demonstrated by dropping the solution of the acetate and subacetate into water charged with the same quantity of carbonic acid gas. The quantity of carbonate formed in the subacetate is considerably greater than that formed in the acetate. In some habits, and in the same person at different times, a greater quantity of carbonic acid than usual is evolved in the intestines. These states of the habit indicate a lower state of vitality in these organs than is requisite to maintain the healthy condition of the system; consequently, in these states I presume that the same quantity of the acetate, or of any of the other salts of lead, will be more quickly changed, and act with more power than in the opposite states of the system and in more healthy

* See Medical Gazette, vol. 10, p. 689.

individuals. This supposition is partly confirmed by the following anecdote. A gentleman returned twice from the West Indies, suffering under palsy, the sequel of colica pictonum, or dry bellyache, as it is termed in the West Indies, produced by drinking sangaree, made of rum distilled through a leaden worm. Many others had partaken of the same rum without being afflicted with the colic ; I was, therefore, anxious to ascertain the cause of his being so particularly its victim ; and, on making strict enquiry into the facts, I discovered that he was in the habit of taking soda powders, containing bicarbonate of soda, at the time of taking his sangaree—a fact which at once fully elucidated the cause of his sufferings. Another fact which supports the theory which I have ventured to advance is this, that those who take the acetate of lead medicinally, in the liquid form, in combination with distilled vinegar, or who drink diluted distilled vinegar, whilst they are taking pills of the acetate, are able to take it in larger doses and for a much longer period of time with impunity, than those who take it without this adjunct.

The manner in which the Carbonate acts upon the habit is not so easily explained. As an Astringent it corrugates the circular fibres of the intestine ; whilst, at the same time, it exhausts the energy of the motor nerves, producing paralysis of both the upper and the lower extremities. The fact of the action of the Carbonate of Lead on the muscular fibre is demonstrated by post-mortem dissections : the colon is generally much contracted ; and, when the disease has been of long continuance, or has frequently occurred to the same individual, the intestines are found almost exsanguine, tender, and with an evident disposition to run rapidly into putrefaction. The mesenteric glands, also, in such cases, have been found enlarged. In experiments made upon the lower animals, when the paralysis is not of long standing, the whole muscular system is found pale, bloodless, and flaccid : but no other part indicates the presence of disease. In this respect, therefore, the salts of lead act through the nervous system in the same manner as the narcotic poisons, exhausting the motor nerves of their energy, but, in the majority of cases, in a degree adequate only to the production of paralysis.

In fifty cases dissected by Seuve, of individuals who had died of colica pictonum, no morbid appearances could be traced. Gmelin asserts that salts of lead may be detected in the bodies of those who have died of colica pictonum: but no other person has been able to find any traces of them, either in the intestines, liver, lungs, blood, urine, or fæces of the animals destroyed by them. The experimentalists, however, of the Veterinary School of Lyons, found the blood in the veins of a dog, who had been poisoned by litharge, of a vermilion colour, and that in the arteries brighter than usual. Having destroyed a dog by injecting a solution of the acetate into the jugular vein, the pink colour described by the veterinarians of Lyons was perceived in the blood. From these facts, it is evident that, in cases of poisoning by salts of lead, when the issue is fatal, little satisfaction can be obtained from the post-mortem inspection of the body; and the whole of the evidence must be drawn from the nature of the symptoms and the analysis of any portion of the poison which remains.

With regard to the practical inferences to be drawn from the theory which I have ventured to advance, I would say—1. that the acetate of lead is the least poisonous of all the salts of lead medicinally employed; 2. that its safety is increased by the addition of as much diluted acetic acid as will prevent its decomposition by the animal matter and the carbonic acid of the contents of the stomach and bowels; 3. that the directions to give alkaline carbonates in cases of poisoning by Acetate of Lead are highly improper, in as much as these salts facilitate the formation of the carbonate, which is the most poisonous of all the salts of lead; 4. that the subacetate, under no circumstances, should be internally exhibited; 5. that the carbonate should be applied with caution, even to external sores. The first thing to be done in cases of poisoning by any salt of lead is to evacuate the stomach by means of the stomach pump or the sulphate of zinc; then to exhibit sulphate of magnesia or phosphate of soda, both of which, by reason of their acid bases, decompose the salts of lead, and convert them into insoluble inert compounds, which are carried through the bowels by the undecomposed portions of the sulphate and phosphate. The remainder of

the treatment consists in the repeated exhibitions of oleaginous purgatives, particularly castor oil, in conjunction with anodynes: whilst, at the same time, the warm bath should be used. In the early stage of the disease, when the pulse is full and hard, bleeding has been resorted to: but I have never seen a case in which it was required. When the paralysis of the extremities has already commenced, the treatment with acetate of strychnia, and passing a current of electricity, either by the ordinary machine or by the Galvanic apparatus, through the abdomen, are the best remedial means that can be adopted. It is of great importance to caution workmen, who from the nature of their employment are constantly handling white lead, or even metallic lead, never to take a meal without washing their hands; and to endeavour to convince smelters and other manufacturers of salts of lead or preparations of the metal, from which fumes may exhale, to have some means of carrying off these exhalations, which prove so injurious to their health.

The custom of prescribing infusion of roses, acidulated with sulphuric acid, at the same time with pills containing the Acetate of lead, in hæmoptysis and other hæmorrhages, is very absurd: the salt of lead is decomposed, as soon as the infusion enters the stomach, by the sulphuric acid; and, consequently, in these cases, if any benefit be received, it can only be justly ascribed to the sulphuric acid, and in no degree to the salt of lead. Indeed, a more decided method of destroying the action of any salt of lead could not be adopted.

f. COLD.

Cold is a negative property, being the mere absence or abstraction of a positive quality, *Caloric*.

It is unnecessary to refer to the laws which regulate the action of Caloric, either on dead and inert matter, or on the living system: nor is it necessary to refer to that power of the body which enables it to maintain a temperature distinct from that of the circumambient medium or atmosphere in which it lives. The same power which enables the body to sustain very high temperatures, enables it equally to maintain its inherent warmth in very low temperatures. Our enquiry,

at present, refers merely to the influence of Cold on the body in a state of disease. It is in this condition of the body only that Cold operates as a sedative astringent.

The first effect of Cold, when applied to the living body, or rather of a sudden abstraction of heat from the living body or any part of it, is a peculiar sensation which is accompanied with paleness and corrugation of the skin. This is the result of a contraction of the capillaries; and so far it operates in a manner somewhat resembling that in which it acts upon dead animal matter. In the living body, however, its effects are not confined to the surface, but they are propagated to internal and distant parts; and it is owing to this sympathetic action that the entire system feels the influence of Cold when applied only to a part. The effect of this sympathetic influence is well illustrated in epistaxis, which is often checked by cold bodies applied to the neck, the back, or even to the genital organs. In reference to the surface, the first effect of Cold is truly astringent, in the strict meaning of the term; but if the application of the Cold be only for a short time, or transient, a reaction occurs in the system; during which a hæmorrhage, that has been checked, is very apt to return with redoubled violence. To render Cold, therefore, beneficial as an Astringent, its application must be continued for some time; but, when thus applied, its power of checking hæmorrhages is to be ascribed equally to its sedative as to its astringent influence.

The effects of Cold vary according to the nature of the medium employed. Thus, cold, humid air abstracts caloric more quickly from the body than dry, cold air, which is a worse conductor: and the effects of cold water, applied under exactly the same circumstances of the body, differs according to the purity of the water. Count Rumford states that the conducting power of moist air to that of dry air is as 330 to 80; and it is even greater than that of water, which is only 313. I might here suggest a question which has often presented itself to my mind in reflecting upon this effect of moist air— "What influence has this depressing power of a humid atmosphere in the production of agues?" This is a question which I cannot pause to investigate; but it is one of

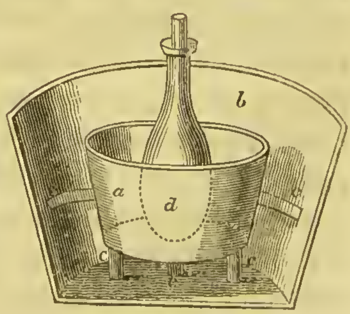
much importance in a practical point of view. The following experiment demonstrates that much of the diversity in the sedative or astringent influence of cold water depends on its purity. Dr. Currie immersed one person in sea water and another in fresh water for thirty-five minutes: the sea water caused no inconvenience, whilst the fresh water lowered the system so much that friction was necessary to restore the natural temperature. In the application, therefore, of Cold, as the means of stopping or checking hæmorrhages, we must bear these facts in remembrance, and not less so, that it is the continued application of the Cold, by whatever medium it is applied, that effects the benefit. Let us examine the media by which heat can be suddenly abstracted from the body in the management of hæmorrhages. If the flow of blood be from the vessels of the bronchia, producing hæmoptysis, it has been customary to expose the body to the free action of cool air, and to give ice internally; keeping, at the same time, the lower extremities warm, to produce a more equal distribution of the blood, and to prevent it from accumulating upon the pulmonary vessels. Hæmoptysis occurs especially at that period of life when the animal frame has just acquired its full growth. Before this period "the impetus and determination of blood are greater in the aorta and its extreme ramifications than in the pulmonary system;" but when the necessity of a further elongation of the aortic system ceases, the bias is thrown upon the pulmonary vessels, in which there is a tendency to accumulate from their shorter extent; and if these vessels be not equal in the strength of their coats to the additional burthen, they may give way from a variety of causes; as, for example, violent muscular exertion, sudden exciting passions of the mind; vomiting; coughing; a suppressed discharge from the hæmorrhoidal veins in bleeding piles; or from whatever suddenly throws an additional jet of blood on the already overloaded vessels. The obscurity in which the causes of hæmoptysis are often involved is very great. I attended the late Charles Mills, the Historian of the Age of Chivalry, who was attacked with hæmoptysis when walking very leisurely in the street. The application of Cold, in the manner which

I have already described, the administration of ice internally, and the free exposure of the trunk of the body to cool air, with the internal exhibition of acetate of lead, soon checked the flow of blood. He recovered and lived upwards of twelve years after this attack, although the spitting of blood ocasionally recurred. This is one of the many instances which have come under my care, in which the flow of blood from the vessels of the lungs has been staunched by the proper application of Cold, under the form of ice and cold air. In these attacks, when the blood vessels are overloaded, and the system not in an exhausted state, if rupture be suspected, the use of Cold should be delayed for a short time, to permit the vessels to unload themselves; after which, rest, cold air, ice, or the effusion of water nearly at the freezing temperature, will be found the most effectual means of checking the discharge. It is of little consequence to determine the source of the hæmorrhage, whether it proceed from the mucous membrane of the bronchi, a tubercular cavity, or the parenchyma of the organ; the effect of Cold is in all the same. In melæna, or bleeding from the intestines, the effect of Cold, as an auxiliary during the presence of the discharge, is equally efficacious. If a vessel have given way in the rectum, Cold can be directly applied to the part, either by the introduction of a piece of ice, cut round so as not to irritate the gut, or by the injection of iced water, which is perhaps preferable to the ice itself, as something is also effected by the distention of the gut. In hæmorrhages proceeding from the uterine vessels, Cold can be most effectually applied by means of the stomach pump, sending a continued stream of cold water upon the surface on which the open vessels are pouring out their blood. In this case we act in the same manner as in stopping hæmorrhage from a bleeding stump after amputation, when a number of small vessels have not contracted and continue oozing out blood. I have had an opportunity of witnessing the use of the stomach pump, under my directions, in several cases of obstinate uterine hæmorrhage; and I never saw the desired object so rapidly obtained by any other means. I may here mention a useful fact—that, in cases of uterine hæmorrhages, the most advan-

tage is obtained when the Cold is applied with a shock. Thus, Dr. Gooch mentions a case in which ice applied to the abdomen was of no use, but cold water, dropped from a height of several feet upon the abdomen, produced an instantaneous contraction.

The hæmorrhages in which Cold exerts the greatest influence are, undoubtedly, those of an active description : and thence the necessity of its continued application for some time after the flow of the blood has ceased. I refrain from noticing the effects of Cold as a general refrigerant, and also its application locally, in inflammatory cases, as this will come more properly under our notice when we treat of refrigerants. In summer, when ice and cold water cannot easily be procured, it is of importance to know the best frigorific mixtures where snow or ice is not necessary.

1. Five parts of muriate of ammonia, + 5 of nitrate of potassa and 16 of water, sinks the thermometer from 50° to 10°: —2. The same, with the addition of 8 parts of glauber salts, sinks it to 4°:—and, by various combinations of this kind, great artificial Cold may be procured. When ice can be procured, an excellent frigorific mixture is obtained by mixing equal parts of pounded ice and muriate of lime. In making frigorific mixtures, it is necessary to cool down the vessels and the water to be used, in the mixtures, and to envelope the vessels in flannel or some other non-conductors. This is well understood in warm climates where ice is regarded as a necessary of life. Thus, the Neapolitan peasants, who carry snow from Vesuvius to Naples, during the heat of summer, envelope the vessels in wool and cloth. The vessel containing ice should be placed within another, containing ice also, the inner one being supported by corks, which are bad conductors (see marginal figure :— *a* the inner vessel, *b* the outer, *c c c* corks to support the inner, *d* the bottle containing water). A temperature of 32° Faht. is adequate for every purpose which can be expected from the influence of Cold in checking hæmorrhages.



Evaporating lotions operate also as Astringents by reducing the temperature of the part to which they are applied: but as the effect is both more slowly produced and less permanent, they are not so frequently employed as cold water and ice; although the stimulant nature of some of their components—alcohol, acetic acid, and ether, for example—add greatly to their astringent influence. They are more employed as direct refrigerants than as Astringents.

Such are those Astringents that exert a sedative influence on the living system: a few brief remarks will suffice to convey all the information necessary to be communicated respecting those of the last division of the table.

c. SUBSTANCES OPERATING CHEMICALLY AS ASTRINGENTS.

g. Calcis. Carbonas Calcis; Creta. *Carbonate of Lime; Chalk.* L. E. D.—The sources of Lime, its nature as a metallic oxide, its solubility in water, and several of its chemical properties in combination, have been already noticed.

As an Astringent, pure Lime, in solution as lime water, operates, by its chemical property of uniting with acids, and also by its sedative influence, on the irritability of the living animal fibre; but it does not corrugate nor condense that fibre; and, therefore, in the strict meaning of the term, it is not an Astringent. Nevertheless, as diarrhœa frequently depends upon the presence of too much acid in the stomach and intestinal canal, and occasionally on an increased irritability or susceptibility of impression of the mucous membrane of the intestines, it is obvious that, in this disease, depending upon either cause, lime water may prove useful. From the small quantity of Lime, however, which lime water contains, it is more likely to operate, by its sedative influence, in the acute form of the disease. It is probable that, in the chronic state of diarrhœa, in which, from the general relaxation and debility of the habit, the secretions poured into the intestines are in an imperfect state, that some part of the benefit resulting from the use of lime water is to be attributed to its combining with these fluids and diminishing their acrimony. It is supposed that the Lime in

lime water enters the system: but this is not very likely to be the case, when we consider the quantity of carbonic acid which it meets with in the bowels; and that, as a carbonate, it is insoluble, and consequently inert. It is true that it also meets with muriatic acid in the stomach, and the muriate of lime is a very soluble salt: but if this be absorbed, the Lime has already lost its character of a simple earth, and no longer can it be regarded as Lime. Lime water is also supposed to exert a stimulant and tonic influence on the habit; but I am inclined to attribute the results which have led to this supposition to its power of allaying irritability, by the sympathy of the system with the intestinal canal. On the same principles we may explain the utility of lime water in the last stage of dysentery. Lime water may be taken to the amount of several pints in a day. It is generally administered in combination with milk: but, as this fluid contains oily matter and carbonic acid, the propriety of such a vehicle may be questioned. Barley water with a small portion of sugar is a better vehicle for the administration of lime water. Upon the whole, lime water is an inconvenient medicine for producing an astringent effect upon the intestinal canal.

Carbonate of Lime, or Chalk, is found abundantly in many parts of the world; and, in particular, in the southern portion of this island, in massive beds, traversing it in a range which commences at Flamborough Head, in Yorkshire, and passes through the midland counties to Surrey, Kent, Sussex, Hampshire, and Dorsetshire. It is generally yellowish-white, or snow-white, opaque, of a dull lustre, friable, inodorous, insipid, and adhering slightly to the tongue; probably owing to its absorbing the moisture of the organ, and thus coming more closely into contact with the papillæ: it effervesces with acids, forming salts of various kinds, and generally contains about 56 per cent. of Lime.

For medicinal purposes, Chalk undergoes levigation and washing. It operates solely by uniting with the acid in the stomach and intestines, which often produces and keeps up diarrhœa. It is formed into mixtures with mucilage, which suspends the chalk; and is usually combined with opium

and aromatics. It is incompatible in prescriptions with medicines containing tannin, as, for example, infusions of galls or other astringent vegetables, or acidulous salts which contain an acid that forms an insoluble compound with Lime, alkaline carbonates, borates, oxalates, and all the metallic salts. After Chalk has been used for some time, the bowels should be cleared out, as it is apt to form into hard balls, and to lodge in the folds of the intestines.

USE OF ASTRINGENTS IN THE CURE OF DISEASES.

With regard to the practical application of astringent substances to the cure of diseases, the view which I have taken of this genus of medicines points out the class of diseases in which they are most likely to prove curative.

In febrile diseases, Astringents have been extensively employed. In intermittents most of the vegetable astringents have occasionally proved successful. It then becomes a question, how do they operate in these diseases? We can form no other idea of the manner in which Astringents prove salutary in ague, than by supposing that they obviate the relaxation and debility which favours the formation of that disease. And on the supposition that this idea of their mode of operating is correct, we can readily conceive that tone must be the result of their action on the extremities of the motor nerves; by the effect which this must necessarily produce in the moving fibre, which acquires a greater cohesive property and a higher corresponding degree of tone. It is, nevertheless, questionable whether much of the power of vegetable tonics—such, for instance, as the cinchona bark—be due to the astringency which they possess; since we find that sulphate of quinia, which is not astringent, cures agues: but whether its powers would be augmented by the addition of Astringents is a point still to be determined. This theory, however, applies to those Astringents only which exert a tonic influence on the system; and it cannot, therefore, explain the manner in which all Astringents cure these diseases. Astringents, however, are seldom given alone; and, therefore, they are to be regarded rather as adjuncts than as primary remedies in intermittent fever. They are not em-

ployed in continued fevers, unless to check incidental diarrhœa.

In inflammatory diseases, which assume a chronic character and are kept up by debility and want of tone in the part, with increased nervous excitability, such as occur, in some instances and habits, in the eye and the tonsils, Astringents, as local remedies, are of great value. The best Astringents in such cases are the metallic salts of the first division of the Table; or, when this kind of inflammation attacks the tonsils, or in the debilitated state of these parts after acute inflammation, gargles, composed of vegetable infusions and decoctions of the plants yielding tannin, with the addition of the diluted sulphuric acid, are to be employed. Indeed, after the undue degree of action in every inflammation is subdued by the use of the lancet, calomel, and purging, nothing tends more to restore the healthy action of the part and reduce the distention which is one characteristic of inflammation, than cold and astringent applications: the first, and most important effect of these is to contract the diameters of the vessels, and thereby permit the blood to be again freely transmitted through the inflamed part.

In hæmorrhages, Astringents are peculiarly indicated, and have been much and successfully employed. Let us endeavour, however, to discriminate under what circumstances they are to be regarded as decidedly fitted to relieve these affections. Hæmorrhages are properly divided into *active* and *passive*. In the first, the habit is in a state of increased tone; the bleeding which occurs arises from a plethoric state of the vascular system, and indeed may be regarded as an effort of nature to relieve this condition, in as much as it unloads the distended vessels; and when this occurs, the plethora being reduced, the hæmorrhage generally spontaneously ceases. It must, however, be clearly understood that hæmorrhage in this state of habit does not always imply a rupture of vessels: the blood is exuded from the ultimate vessels of the capillary system; how it occurs is not clearly understood; according to Bichat, it depends on what he terms exhalation. Most idiopathic active hæmorrhages are of this kind; and some, also, which are symptomatic of dis-

eased structure—such, for instance, as occur in incipient scirrhus of the stomach, or which proceed from the mucous membranes affected with violent inflammation. In this state, the Astringents in the first division of the table, those exerting a tonic power, are undoubtedly improper, and even those exerting a sedative influence should not be employed until the vessels are relieved either by blood-letting or by bleeding at the ruptured orifice, if rupture have taken place.

In the second state, passive hæmorrhage, the animal fibre is lax and weak; the blood contains few red particles, compared with those which afford it the florid hue which characterizes its healthy condition; and these are diffused in a superabundant proportion of serum. This change in the relative proportion of the compounds of the blood is demonstrated in sea scurvy, and that singular disease which so closely resembles it, Purpura *hæmorrhagica:* in both cases there is great general debility of the system. In this state of the habit, tonic astringents are most advantageously employed to check hæmorrhage, and may be liberally administered.

In description, these opposite states of the system appear perfectly obvious; but much judgment and attentive observation are often required to distinguish between them in practice. Let us investigate this point a little in detail. What, for instance, are the circumstances under which Astringents are to be employed in Epistaxis, or bleeding from the nose? When this flow of blood generally occurs in young persons about the age of puberty, and especially those of plethoric habits, it may be critical, or connected with particular congestions, or with a determination to the head. In this state it must not be checked by Astringents; unless it have been so profuse and long continued that the pulse has become weak, the face pale, and the strength much exhausted. On the contrary, when bleeding from the nose occurs in weak debilitated habits, in old persons, when it is of an atonic character, or when it is symptomatic of some diseased organ—as, for instance, the liver—then Astringents, although they may be employed to check the direct loss of blood, yet, at the same time, other means must be resorted to for removing the exciting cause of the hæmorrhage. The best Astringents in

these cases are those that produce a general sympathetic influence, such as cold water applied to the face and back of the neck; solutions of the metallic salts and of alum, snuffed up the nostrils or applied by means of dosils to the bleeding vessels; and, for internal administration, infusion of roses or of kino, or some other of the astringent vegetable substances, acidulated with diluted sulphuric acid.

In hæmoptysis, if the excitement be considerable, after bleeding at the arm, the use of cold water and of ice, with binacetate of lead in combination with diluted acetic acid, are indicated. When the effusion of blood from the lungs is considerable, no circumstances should interfere to prevent us from endeavouring immediately to check it: but when it is not of this alarming character, and there is no obvious predisposition to tubercular consumption, especially if it be the consequence of a suppression of the menstrual discharge, it should only be moderated, not checked suddenly, which might induce a congestion in some organ less capable of supporting it with impunity. The kind of Astringent most resorted to in this form of hæmorrhage is, as I have already said, the binacetate of lead; and I have no hesitation in recommending it either alone or in conjunction with opium, in much larger doses than it has hitherto been given. Two drachms of it have been swallowed accidentally, instead of lump sugar, without any serious evil resulting—a constriction of the œsophagus and costiveness being the sole effects experienced. It is necessary to remark, that, when it is given in the fluid state with laudanum, vinegar should be added to redissolve the morphia, which is thrown down with the meconate of lead. Indeed, in every case, the remedy is more safe when given in conjunction with diluted acetic acid, which prevents its conversion into the carbonate of lead.

The same practice and cautions are requisite in the employment of Astringents in hæmatemisis and melæna. But there the Astringents can be more immediately applied to the bleeding vessels: cold water, either alone or containing the tincture of muriate of iron or Ruspini's styptic, may be administered by the mouth or per anum. In treating vomit-

ing of blood, however, we must always bear in remembrance that this hæmorrhage is seldom idiopathic, and consequently that the propriety of the administration of Astringents, as of every other remedy, must depend on the nature of the primary disease. The exhaustion which occurs in hæmatemisis also requires some caution in prescribing sedative Astringents, such as the binacetate of lead; and it is even necessary to combine cordials with the Astringent when the sinking is considerable. Solutions of the gallic acid, in combination with an oleo-saccharum, are highly serviceable in this state of the stomach.

In hæmorrhoids, the propriety of employing Astringents depends altogether on the remote causes of the disease. The most common of these is a confined state of bowels; thence purgatives, or rather laxatives, are indicated: when there is heat, hardness, and much pain, leeches should be applied; but after these symptoms are removed, or where they are not present, when the piles are large and the bleeding excessive, then Astringents should be employed. A pint of cold water thrown into the rectum every morning, by means of a gum elastic bag, an ointment composed of powdered gall nuts, or of kino or catechu and lard, or solutions of the metallic salts, such as sulphate of zinc in solution of alum, may be administered. When hæmorrhage proceeds from a ruptured vessel high up in the rectum or in the colon, the stomach pump should be used, either to throw in cold water, or infusions of the astringent vegetable bodies, or solutions of the saline Astringents. Whatever be the nature of the astringent solution or infusion, the quantity should not be such as to irritate by distention or to cause too rapid an evacuation of the injected fluid. Accompanying this state of the hæmorrhoidal vessels, we not unfrequently find prolapsus ani, or falling down of the fundament. This also occurs occasionally in children and in old people, from mere debility, on the slightest effort to relieve the intestines of their contents. The return of the gut in this state is easily effected; but it is only by bracing and invigorating the loose and relaxed membrane that we can expect it to remain in its proper place. This is

best accomplished by astringent injections; and nothing is so well adapted for these as the infusion of the pomegranate bark, or that of baulistines.

Hæmuturia, or bleeding from the bladder, is generally depending upon some organic affection of the urinary organs; but, in attending to the primary disease, much immediate advantage is derived from the use of Astringents. It was in a case of this kind that Mr. Brodie administered Ruspini's styptic with so much seeming advantage; and I have seen great benefit, in similar cases, from the use of uva ursi, which appears to pass unaltered through the kidneys. Since the discovery which I have made of the composition of Ruspini's styptic, I am disposed to propose a combination of gallic acid with an infusion of the leaves of uva ursi, obtained by rubbing them in cold water.

In mænorrhagia, the employment of Astringents is very much to be regulated by the nature and cause of the disease. They are most useful where there is debility of the general system connected with relaxation of the uterine organs. In this state nothing is so useful as cold water, injected, per vaginam, by means of the stomach pump.

In every instance of general hæmorrhage, it must always be recollected that more or less hazard exists; that, even whilst the hæmorrhage tends to relieve a plethoric state of the habit, it may induce as dangerous a disease; and that, whenever it proceeds to excess, it either endangers life, or a state of debility follows which is with great difficulty, and only after much time, repaired. It has also, as Dr. Cullen justly remarks, "a tendency to increase the plethoric state it was meant to relieve; and thereby to induce a habit which may be attended with much danger." It is not my duty to point out the general mode of managing these effusions of blood; but to confine myself to the consideration of one set of remedies useful for suppressing them—Astringents. In active hæmorrhages, when Astringents are required, the preparations of lead are to be preferred: in passive hæmorrhages, on the other hand, we are to choose the vegetable and fossil Astringents; and, among these, alum is both powerful and safe; and it has also another quality which renders

its employment preferable to many other Astringents—it can be combined with some of the metallic salts—as, for instance, the sulphates of iron and of zinc, and with some aromatics, without decomposition—if the exhausted state of the patient demand such props.

For external application, or where a medicine can be applied to the bleeding vessels, cold water is undoubtedly the most powerful Astringent. Whatever, however, may be the agent employed, the great object of the application, if rupture of vessels exist, is the formation of a clot or coagulum over the bleeding orifices; and, when this is once formed, rest should be enjoined, all applications suspended, and every pains taken to prevent the clot from being disturbed. When Nature has performed her curative process, and the vessel is again a continuous tube, the clot will fall off and leave the part, although not so entire as at first, yet comparatively sound and sufficient for its function.

The use of Astringents is also indicated in dysentery; but their employment in this disease requires great caution. Whatever may be the cause of the attack, whether contagion, cold, or vitiated food, dissections of fatal cases have displayed traces of inflammation in the mucous coat of the larger intestines; and there is every reason for believing that no case of dysentery, which has run on beyond the first stage, has ever occurred in which inflammation was absent. If in this disease Astringents be indiscriminately employed, they increase the inflammatory tendency, with all its consequences, and seldom fail to produce meteorismus. The principle on which dysentery is most advantageously treated is the evacuant; while opiates are given to allay the inordinate irritation, and ipecacuanha to determine to the surface, and thereby maintain the due balance of the circulation. When diarrhœa comes on towards the termination of the disease, and threatens to produce a dangerous debility, and when at the same time the powers of the stomach are much weakened, mild Astringents may be administered; such as small doses of kino or of extract of logwood, in combination with the compound powder of ipecacuanha: but these must not be given together, as is too frequently done; for the astringent vegetable extracts com-

pletely destroy the efficacy of the ipecacuanha. When given during the continuance of the dysenteric symptoms, that is, whilst the griping and tenesmus are present, Astringents have generally been found to augment these symptoms. There is indeed but one circumstance which can authorize their exhibition under such circumstances; namely, when there is a copious discharge of blood; in which case the diluted sulphuric acid and alum are the remedies to be relied upon.

In the latter stage, that period of the disease in which Astringents are admissible, alum and rhubarb, in small doses, in combination with opium, will be found beneficial. In the decline of the disease, also, those substances which produce an astringent effect by their chemical influence, in neutralizing the acidity of the primæ viæ which prevails at this period, may be advantageously employed; and with these, as well as with the other Astringents, opium may be beneficially combined, particularly when the patient is still harassed with gripings. Great advantage is also obtained, in this stage of the disease, from the use of the mineral acid, in combination with sulphate of zinc, or sulphate of copper and opium. To this union, also, alum may be added; and a medicine is thus obtained which, at the same time that it exerts a powerful astringent influence on the sanguineous and secernent system, rather tends to increase than to diminish the peristaltic motion of the bowels. Nitric acid, in combination with double the quantity of muriatic acid, largely diluted with some astringent vegetable infusion, is also highly proper and very beneficial in this stage of dysentery. Perhaps none of the vegetable infusions is a better vehicle for the nitro-muriatic acid than that of the Simaruba bark. Where there is reason for suspecting ulceration of the rectum, weak solutions of the sulphates of zinc or of copper, in quantity not exceeding a grain of the salts in three or four ounces of water, may be thrown into the gut as an injection.

Astringents may be administered with much greater freedom in diarrhœa: but even in this disease some attention is requisite to the period of the disease, and also to the choice of the Astringent; the increased peristaltic motion depending

on very different causes. Thus diarrhœa may arise from diet, the aliments being of a too acescent or otherwise indigestible nature; or it may proceed from a vitiated state of the secretions—as, for instance, of the bile or the pancreatic juice, or that furnished by the coats of the intestines themselves—or from cold applied to the surface, checking perspiration and determining an inordinate quantity of fluid to the intestines; or, finally, diarrhœa may be the result of a laxity in the simple and moving fibres of the whole canal. From the consideration of these causes, the practice in diarrhœa is very obvious. In an acescent state of the contents of the intestines, those Astringents which neutralize acid present themselves; if the acrimony proceed from vitiated secretions, after removing those already present by the operation of a purgative, we should employ the sedative Astringents in combination with opium; whilst those Astringents that exert a tonic influence, those containing tannin and gallic acid, especially infusions of the krameria and tormentilla, or the pomegranate bark in combination with aromatics, may be freely administered, when the irritability of the intestines depends upon a loss of tone, whether this arise from debility of the whole system or from causes acting on the intestines alone. It is curious to notice the difficulty of ascribing effects to their proper causes: Dr. Fordyce thought he had improved the practice in diarrhœa by combining Astringents and diaphoretics; and therefore recommended a combination of ipecacuanha and tormentil. We now know that no effect could be ascribed to the ipecacuanha in this combination, as an inert tannate of emetina is formed; and consequently that the whole of the benefit must have resulted from the tormentil, which is indeed an excellent Astringent in this disease.

In diabetes, Astringents have been much employed, from the idea that the disease depends upon the laxity of the renal vessels. They are recommended by Celsus, and are supposed to act by constricting the extreme vessels of the kidneys: it is true that from this cause they diminish the quantity of the urine, but do not alter its saccharine quality. Sydenham recommends the malecorium; whilst kino, cate-

chu, uva ursi, alum, and sulphate of zinc, have each its eulogists. Astringents have occasionally proved beneficial; but they are not to be trusted to in this intractable malady.

In that state of the habit which has been termed Ephidrosis, in which there is a propensity to immoderate sweating, Astringents have been found highly beneficial. It is true that this affection is generally symptomatic, and can, therefore, be cured only by curing the primary disease: but sometimes it is idiopathic, or the accompaniment of great general debility; in which case the diluted sulphuric acid, in combination with the decoction of krameria, or some other of the vegetable Astringents, is indicated. When the disease is not chronic, Astringents are less useful; and more benefit is likely to accrue from moderating the temperature of the surface and determining the fluids to the abdominal viscera by diuretics and purgatives.

In gonorrhœa virulenta, there has been much diversity of opinion with regard to the use of Astringents; for, while sometimes they appear to check the usual course of the disease, at others they apparently increase the discharge and inflammation. Thus, in the incipient stage of gonorrhœa, when there is a slight turgescence only of the lips of the urethra, before any increased secretion is discovered, the employment of an astringent injection, sufficiently stimulating to produce some irritation of the internal membrane, will sometimes altogether arrest the disease: and equal advantage results from the same application when there is no pain or scalding in making water, but merely a discharge. The injections for this purpose, which have been found most effectual, are solutions of the metallic salts contained in the first division of the table; particularly the sulphate of zinc, in the proportion of two grains of the salt to f℥i of distilled water; or the sulphate of copper in the proportion of half a grain to f℥i of water. When the pain and scalding are sharp, then the best injection is the binacetate of lead, decomposed by the sulphate of zinc and opium, rubbed up with mucilage to suspend the precipitate: the vehicle may be either rose or common distilled water, according to the quality of the patient. I have

always found it better not to filter this mixture. How this tends to augment the power of the injection I cannot explain; but the fact is undeniable. Another useful injection is found by dissolving from 5 to 10 grains of sulphate of alumina and potassa in a f℥i of water; or an infusion of galls or of kino may be employed. Such are the best Astringents for gonorrhœa, when the symptoms are mild and the disease in an incipient state. When, however, on the other hand, the ardor urinæ is considerable, the chordee frequent and painful, and there are, besides, sympathetic pains in the loins, groin, and thighs, with much general excitement in the habit, then the employment of Astringents will prove injurious: but as soon as the tenderness of the urethra has somewhat subsided, Astringent Injections may be resorted to. Besides those already mentioned, another Astringent Injection has been much vaunted, the solution of twenty minims of the liquor Cupri ammoniareti in four ounces of distilled water: but this solution of the ammoniaret of copper, however, possesses no superiority over the solution of the sulphate of copper.

The use of Astringent Injections, in any stage of gonorrhœa, has been objected to by some practitioners, under the idea that they tend to induce strictures and other diseased conditions of the urethra—an opinion, however, which is not at all supported by experience: on the contrary, it is the long, uncontrolled inflammatory action which is productive of these states of the urinary canal. When gonorrhœa, under any form, occurs in the female, Astringent Injections may be more freely used than in the male; and they may be also much stronger. In both sexes, as the effect of the Astringent on the diseased membrane is transitory, the use of the injection should be repeated at short intervals; for it is by maintaining the artificial action which the stimulus of the Injection induces, for a time sufficient to overcome the morbid action, that the cure is effected. But, sometimes, with the utmost care and attention in their application, and with the most judicious discrimination as to the circumstances under which they are employed, Astringents prove either injurious or are utterly inefficient in relieving gonorrhœa.

In leucorrhœa, a disease in which the natural mucous discharge of the vagina in females is greatly augmented, and often connected with a peculiar chronic state of inflammation of the part, Astringent Injections have been freely used. In these cases, however, it is essential to discriminate between mere laxity, inducing an increase of the natural excretion from deficient action in the absorbents, and that state of excitement in which the discharge is not only augmented in quantity, but also greatly altered in quality. In the first state of the case, the decoctions of the vegetable astringents, or the solutions of the metallic salts in the first division of the table, or the solution of alum, will be found to prove most beneficial: in the second state, it is often useful to apply leeches over the pubis, or on the groins, previous to the employment of any Astringent Injection; and, when the period to use Astringents arrives, to select those which operate by exerting a sedative power on the habit.

In all the symptoms of calculi in the urinary passages, the use of Astringents has been followed by beneficial results. It has even been affirmed that calculi have been dissolved by Astringents taken into the stomach; and those who maintain this opinion also contend that all solvents of calculi, or lithontriptics, as they are termed, possess astringent properties. This opinion may have arisen from observing the effects arising from the administration of uva ursi; but this is not always successful in relieving the pain attending calculus in the kidneys: and when it succeeds, the effects can be explained on more rational principles than those which suppose the solution of the calculus. It is probable that any benefit derived from the administration of astringents in calculous affections is to be ascribed to their action upon the first passages; to their giving tone to the stomach; and, by allaying irritability, favouring a more healthy secretion of the gastric juice, and a more complete conversion of the aliment into healthy chyle. The derangement of the stomach, and the formation of acid in that viscus and the intestines, favour the deposition of uric acid in the kidney: whatever, therefore, tends to maintain the tone of the stomach, must ne-

cessarily tend to lessen the predisposition to the formation of calculus; and, in this manner, Astringents operate in relieving calculous affections. In many local affections, Astringents are valuable medicines; and in some we must almost solely depend on their influence for a cure. Thus, in whispering *hoarseness*, or partial loss of voice, the result of that weakness which follows repeated inflammatory attacks in the vocal organs, we find a combination of stimulants and astringents highly serviceable: for instance, a moderately strong syrup of horse raddish, allowed to dissolve in the mouth, and to be slowly swallowed, with gargles of solution of alum, or the infusion of some astringent vegetable—as, for instance, the bark of the krameria root—seldom fail to relieve this distressing affection.

As external applications, Astringents are of much importance in the operations of the surgeon. They are particularly adapted for that species of ulcer which is connected with laxity of vessels: such, for example, as is characterized by a livid aspect of the surface, and a thin, acrid discharge; especially when the ulcer has existed for a considerable length of time. In such cases, the solutions of the metallic salts, in both divisions of the table, and the powders of the vegetable astringents—for instance, galls or kino—in conjunction with compression, are of the utmost benefit. Strong decoction of oak bark has been found effectual in curing the tendency to inguinal hernia in children. In many local inflammations, as burns, scalds, and excoriations, the application of astringent lotions is found beneficial; nor are they less so in those symptomatic, superficial inflammations which are attendant on certain febrile states of the habit; as, for instance, erysipelas, erythema, and herpes. In ophthalmia, much of the benefit derived from nitrate of silver depends on its astringent power. In apthæ, another disease in which the local application of Astringents is useful, much benefit is also obtained from the nitrate of silver; and I would strongly recommend its adoption in preference to litharge water, which Dr. Latham has eulogised in combination with opium. Upon the whole, Astringents form a very important

class of remedial agents; one which merits attention, not only on account of the frequency of its application, but of the nature of many of the diseases which its members are fitted to relieve.

SECTION IX.

VITAL AGENTS WHICH OPERATE ON THE SECERNING SYSTEM.

THE description both of the classes and the substances arranged under them, in this division of our subject, will be much better understood by prefacing it with a brief sketch of the functions of the Secerning System.

In the most extended meaning of the term, the Secerning System is that part of the animal frame which separates from the blood the general nutrient pabulum, the various substances of which the body consists, as well as those which are necessary for aiding the functions of many of the organs, and those poured out or ejected from the body as excretions. In this definition, however, both nutrition and assimilation are comprehended, and the nutritive and secreting functions confounded. The term secretion is better understood when it is confined to imply the separation from the blood of certain fluids, intended either to aid the functions of the same organs—as, for example, the saliva, gastric juice, bile, and pancreatic liquor, which aid those of the stomach and digestive organs—or to lubricate parts, as the mucus of the urethra; or to prevent the attrition of parts upon one another, as the serous fluid in the abdomen and the synovial in the joints. Secretion also implies the separation of fluids from the secreting mass, the retention of which would prove detrimental to the health of the body; as, for instance, the urine and the cutaneous perspiration. For these various purposes the Secerning System consists of distinct or dissimilar kinds of organs—*pores*, *capillary vessels*, and *glands*.

It would be out of place here to examine the structure of these organs; but a knowledge of the structure of glands

does not elucidate, so much as might, a priori, be expected, the cause of secretion; although it is probable that the intimate structure of the secreting organ influences the nature of the secretion. Secretion is a *vital property;* and there appears to be some foundation for the remark, "that the glands possess a peculiar species of vitality, a *vita propria*, distinct from the common vital powers of contractility, irritability, and sensibility. Without admitting the existence of a peculiar vitality, we can form no idea of the power of organization to produce such varied fluids from the same pabulum; and we must suppose that the elements of the different secretions are spontaneously developed in the blood during its circulation, and only require the aid of the capillary vessels in the glands for their complete elaboration"—an opinion undoubtedly supported by some facts, but at variance with others. Thus, according to the observations of M. Prevost and M. Dumas, when both kidneys are removed from an animal, it survives for several days, during which the characteristic element of the urine, *Urea*, accumulates in the blood—a fact which strongly supports the doctrine of the spontaneous development of the secretions in the blood: but, on the other hand, the secretion of milk can only proceed from the peculiar vital action of the gland itself; and other facts tend to favour the opinion, that the secretions are effected solely by the capillaries of the glands.

A query here occurs—how far is glandular secretion influenced by the nerves? Every gland is supplied with nerves; but this seems rather for affording that nervous energy to the organ which is necessary for its healthy state and its nutrition, than for influencing its function. If a nerve, for example, passing to a gland, be divided or paralysed, the gland will suffer from its nutrition being disturbed; but the secretion will not be perceptibly diminished: it is therefore probable that the nervous energy has little influence on secretion. Besides, it has been ascertained that the secretion is carried on in fœtuses devoid of brain and spinal marrow; and we know that it is a function in vegetables in which no nerves have yet been detected.* Neither are glands pos-

* In plants, the only distinction between the secreting and other tissue is the

sessed of much sensibility, except in a state of disease. There are, nevertheless, some circumstances which countenance the notion that nervous energy influences secretion. Thus, in various affections of the mind, the lacrymal gland is powerfully excited and tears flow: the recollection of sapid or savory food will greatly augment the flow of the saliva; and it is well known that libidinous desires produce seminal discharges. The effect of local irritants, also, whether medicinal or mechanical, in increasing secretion, may be adduced in support of nervous influence on the action of the glands. Thus, the presence of food in the mouth increases the flow of the saliva; the irritation of a sound or a bougie in the urethra, that of the urine; the friction of the glands penis in coition augments the secretion of the seminal fluid; the passage of the food in the duodenum irritates the biliary ducts, and causes an increased flow of bile, which is immediately supplied by a fresh secretion; and every one who has conversed with nurses must be aware of the fact, that the suction of the infant augments the secretion of the milk.

Glands sympathize with other organs:—thus, the liver sympathizes with the brain; the mammæ with the uterus; the testicle with the parotids; and the kidney with the stomach; and it is from a knowledge of this fact, that, on the occurrence of vomiting, in conjunction with acute pain in the kidney, we are enabled to ascertain the presence of a calculus impacted in its pelvis or its ureter.

Some curious and important facts are connected with the influence of rest, age, sex, climate, health, and disease, on the development and functions of glands.

Rest seems necessary for the function of secretion to be perfectly effected; and this is not confined to man and the larger and warm-blooded animals, but extends through all animated nature, even to insects. In bees, for example, it is well known that, before swarming, they suspend themselves

closeness of the cells, and their diminished size in the secreting tissue. The simplicity of this structure is no argument against the fitness of it for the secreting function. The wax in the bee is secreted in an hexagonal cellular tissue which lines the wax pockets: but, in the humble bee, it is found occupying the anterior part of the base of the segments where the wax is found, the humble bee having no wax pockets.

for days like a curtain or festoons before the hive; the intention of which, Huber ascertained to be a greater than usual secretion of wax for the foundations of the combs of the new hive. When they first form this curtain, the wax pockets of the bees are empty; but if a bee be caught when they take their flight, before beginning to work in the new hive, the wax pockets are more turgid with wax than at any other time.

With respect to *age*—in the fœtus some glands, especially the liver and the kidneys, are comparatively larger than those in adult age; they are also more easily separated into lobes, and more largely supplied with blood; but yet they possess no activity, scarcely exerting any secreting power until after the birth of the infant, when some glands become extremely active; as, for instance, the kidneys, secreting a large quantity of urine; or the lacrymal gland, which is excited at this period of life by every passion. In adult age, the testicles, which were inert in boyhood, become active; and, in females, the mammæ swell, and the nipple becomes erectile on the slightest touch. From thirty to forty years of age and upwards, in both sexes, the liver is in great activity, and those diseases which are termed bilious are most common. It is true that mental affections of a distressing kind, such as ambition, hatred, and jealousy, tend greatly to induce an irregular action in the liver: but, independent of these mental influences, age affects powerfully the glandular system. The salivary and the mesenteric glands are frequently diseased at this age; the spleen, the kidneys, and the liver, become more liable to take on a morbid action as life advances; in old age the glands become hard, and the secretions are altered; the action of some glands, as that of the testicles, the mammæ, and the uterus, cease; whilst that of others—as for example, the mucous glands—is greater than ever; thence the rheums and catarrhs of old age. The secretions also become more sapid and odorous, and communicate these properties to the glands; the kidney has always, at this period, an urinous odour; and many glandular parts of young animals, that are eaten and relished as food, become perfectly unfit for the table in old animals.

Sex, even independent of those glands which characterize the sexes, influences glandular secretion: in women the lachrymal glands are more easily excited than in men; women consequently weep more frequently, and for slighter reasons than men.

Climate influences glandular secretion: it is more regular and active in temperate climates than in either very cold or very warm parts of the globe. *Season* also influences secretion: that of the cutaneous system is increased in summer, whilst that of the kidneys is diminished; and, in winter, when the cutaneous excretories are, as it were, shut up, the action of the kidneys is augmented, and the quantity of urine increased.

It is almost unnecessary to remark that, during health, the functions of the secerning system are uniform and regular; but disease both varies them in a thousand forms and destroys the organization of the glands themselves. In hysteria, the kidney becomes affected, and the urine is limpid; yet, as soon as the paroxysm is over, it returns to its natural state: in epilepsy the saliva is more abundant, yet thicker and more frothy than it is in a state of health: and some glands, in a diseased state of the habit, are excited by every change in the system, both corporeal and mental. In disease, also, one gland has its secretion sometimes augmented at the expense of another: in the same state, great local and even general excitements diminish glandular activity: thus, in extensive ulceration, and in dropsy, the system is affected by mercury with great difficulty.

With respect to the secretions themselves, they have been arrranged by chemical physiologists according to the substance most predominant in each secretion; thus, Dr. Bostock arranges the perspiration and pulmonary exhalation under the head of *Aqueous* secretions; the membranous parts of animals he ranks under that of *Albuminous;* and the saliva, gastric juice, tears, and semen, as *mucous* secretions. He has also formed classes of *gelatinous*, *fibrinous*, *oleaginous*, *resinous*, and *saline* secretions. It is not my intention to criticise this or any other arrangement of secretions.

The excreted fluids are, generally speaking, of a more compound nature, than those which are retained for the

purposes of the system. According to Berzelius, they all contain a free acid, the *lactic ;* and in the urine this is united with the uric. Urine, he remarks, contains only a single peculiar characteristic matter ; but milk has three; i. e. butter, curd, and sugar of milk ; which, however, seem to be produced by different organs, which mingle their fluids in the same receptacle. " The perspired fluid appears to have no peculiar matter, but to be a very watery liquid, with scarcely a vestige of the albumen of the blood; and, in short, is the same as all the other excretory fluids would be, if deprived of their peculiar matter." To proceed further with these remarks is unnecessary for our purpose : I have only to add that, whatever is the cause of secretion, or whatever the nature of the secreted fluid when once separated from the blood, it cannot be again introduced into it without being productive of disease and danger. Bichat injected bile into the jugular veins of a dog, and found that it quickly proved fatal : he also injected urine into the same vessels ; the dogs were rendered ill, but did not die. When the secretions are reabsorbed, the same striking effects do not follow, but the health is impaired.

Now, the question may be asked, what is the application of this information to our subject—the operation of Vital Agents, as remedies, on the secerning system ? One answer only can be given, that which must naturally suggest itself; that the action of no agent upon the animal body can be correctly understood without a knowledge of the functions of the part to be acted upon, as well as of the qualities of the agent to be employed. To illustrate this by an example—suppose a patient, in whom the complexion is sallow, the albuginea of the eye tinged with yellow, the urine of a deep orange colour, the pulse labouring, and the mental faculties oppressed ; I correctly conclude that some cause has either obstructed the excretion of the bile, or that this secretion has overloaded the biliary ducts, and has been again absorbed into the circulating mass. How is this to be overcome ? If I know that, by stimulating the orifices of the gall ducts, I shall not only excite that action in these canals which is necessary to empty them of their immediate con-

tents, but also communicate a new action in the gland itself—which, by the increased activity of its secreting powers, will produce a thinner, or more fluid bile, less likely to remain in the ducts, and better adapted for the ultimate purposes of the economy—and if no pain be present to indicate that the obstruction is a biliary calculus, I can proceed with a rational expectation of success in relieving the disease. It is upon this knowledge also that is founded the theories of the modus operandi of eight of the orders of remedies in this class of our arrangement.

To influence the secretions, all medicinal agents must be of a description to exert an excitant power; but every stimulant will not affect, indiscriminately, the whole of the secerning system. Thus, if turpentine be taken into the stomach, its operation will be most apparent on the kidneys and urinary organs; if mercury be introduced into the system, the salivary glands show most decidedly the extent of its action; and, if the remedy be an antimonial, it is upon the cutaneous exhalants, chiefly, that we expect it to operate. This action is also mnch modified by the extent of the dose; for, as the first effect of every stimulant is local, if the dose be sufficiently large to stimulate locally to a certain extent, the result is seldom that secondary effect which is the consequence of smaller and repeated doses of the remedy. Thus, if turpentine be given in doses of six fluid drachms or a fluid ounce, instead of twenty or thirty minims, the kidneys and urinary organs are not affected, because the remedy, stimulating powerfully the motor nerves of the intestines, is carried through the bowels without being absorbed, and never arrives at the kidney: and the same is the effect of mercurials and other excitants; which, in moderate doses, pass into the circulation and operate on particular glands, or generally on the secerning organs.

As the effect of every stimulant which operates on glands secreting an excrementitious fluid is to increase the activity of the gland, it is evident that the effect of every stimulant of this description must be evacuant; and, consequently, although excitement be the first result of the action of such remedies, yet their secondary effect is undoubtedly that of an opposite kind.

SECTION X.

ERRHINES.—MEDICAMENTA ERRHINA.

Syn.—Sternutatories.

Errhines are substances the application of which to the pituitary membrane of the nostrils causes an increased discharge of the natural mucous secretion of that membrane; and, frequently, of a thinner fluid than natural from the nostrils and their adjoining cavities, the frontal, the sphenoidal, and the maxillary sinuses. Errhines, also, occasionally affect the lachrymal glands, and excite a copious excretion of tears; and, in many instances, they cause sneezing, or operate as sternutatories. They were formerly called Apophlegmatica; and, when they caused sneezing, Ptarmica.

The pituitary membrane* being the organ on which Errhines exert their influence, it is necessary, in order to understand the nature of their action, to enquire in what manner the natural secretion of the nostrils is effected.

The pituitary membrane is differently organized in its various parts. It is continuous with the skin, and resembles, in part, this general integument. It is composed of two layers, the exterior-mucous, the interior-fibrous; it is the former only that has any analogy to the skin; the interior being, in fact, merely the periosteum of the nasal bones and cavities. The exterior resembles the skin in its structure; it consists of a very evident *chorion*, about the thickness of that which covers the gums and the palate, serving to support a net-work of exhaling and absorbing vessels, blood-vessels, and nerves, and is covered with an extremely thin and delicate epidermis. In the nostrils, and especially where this membrane covers the turbinated bones, it is softer, thicker, redder, and consequently more vascular than in the sinuses, where it is covered by a more limpid secretion than in the

* This membrane is also named Schneiderian, after a distinguished anatomist of the 17th century, whose work, "De Osse Cibriforme et Sensu ac Organo Odoratus," published in 1665, put an end to the absurd doctrine that this membrane is an emunctory of the brain.

nostrils, which are the principal passages of the air which we breathe, and which, consequently, require to be kept constantly refreshed with moisture: the mucous secretion is supplied by follicles, the simplest of all glands. The supply is required to be constant; and, in the healthy state of the body, to be of a certain spissitude, and bland in its nature; after some time, however, it thickens, concretes, and, irritating the sensitive surface of the membrane, requires to be removed; for, although this fluid is secreted in the membrane, yet, after its aqueous particles are evaporated by the constant passage of the air through the nostrils, it becomes as great a source of irritation to the membrane as if it were an extraneous body. Habit has taught us to relieve ourselves of this source of uneasiness by blowing the nose; but it is probable that the intention of Nature, in the irritation caused by this state of the mucus, is to produce an increased secretion; which, being in a more fluid state, would loosen and throw off that which has become too thick, and therefore requires to be excreted. This points out the means of increasing this secretion by applying something irritating to the membrane that supplies it. Such substances, whatever may be their nature, are Errhines.

Every excitement of the mucous surface produces a corresponding increased action in the glands which are situated beneath it, and the ducts of which open upon it; for the irritating matter is not applied to the glands themselves, but to their excretory ducts; and this effect in the nostrils is only in accordance with the law which regulates the whole glandular system—that the susceptibility of the gland always corresponds to the irritation of its excretory ducts. Thus we find, that the irritation of the mucous membrane of the nostrils stimulates the excretory ducts of the secreting follicles, and not only increases the flow of the natural mucus, but produces a thinner and more acrid secretion than that which is more slowly and naturally secreted. Every mucous surface has its peculiar sensation necessary to excite the unloading of its mucous secretion; that of the organ under our present consideration is a titillation, which either obliges us to blow the nose, or which loosens the mucus in the manner which

I have described, or produces sneezing and ejects the concreted mucus in a forcible manner. In whichever mode it is effected, the object is the removal of the thickened mucus, now unfit for the lubrication of the air passages, and the maintaining the olfactory nerves in a proper state for receiving the impression of odorous bodies to constitute smelling.

Every unusual excitement causes in the pituitary membrane a state of vascular action somewhat resembling inflammation ; and when this extends beyond a certain degree, actual inflammation is produced, which for some time contracts the excretory ducts of the glandular cullender, " les couloir glanduleux*," and stops the secretion. This is obvious in the commencement of catarrhal affections: the nostrils become dry, and it is a symptom of the resolution of the inflammatory action in the part when the nostrils begin to discharge freely. It is probable that these membranes are more susceptible of inflammation than other mucous surfaces, from their constant exposure to the action of the atmospheric air in every act of inspiration. The vascular web, if I may employ such a term, which is spread over them is full of blood, and, being separated from the air only by a very thin pellicle, the membrane is always red. It is not improbable that it derives this colour, as Bichat has suggested, from its either separating a portion of the carbon of the blood or absorbing oxygen ; or, as more modern physiologists suppose, from the alkaline character of the secretion : thus, in a certain degree, acting as an accessory to the lungs. Be this as it may, the red colour of the pituitary membrane depends on the abundance of arterial blood with which it is supplied ; and it is the increased action of the arteries to a degree short of positive inflammation which augments the secretion of the mucous follicles and the consequent flow of the mucus. This is the case more immediately in that portion of the pituitary membrane which lines the nostrils and covers the turbinated bones. In the adjoining communicating sinuses the membrane is thin and supplied with few arterial vessels ; but it is covered with vessels of a peculiar nature, that exhale a

* Bichat.

watery vapour, which, condensing, is poured into the nostrils, in every position of the body. It is from this portion of the pituitary membrane that the very copious supply of watery discharge from the nostrils proceeds in catarrh, amounting in some cases to several fluid ounces in the course of a day: and it is from the same portion of this membrane, excited by its continuity with that part of it which covers the nostrils, when stimulants are applied to the nostrils, that the greater part of the discharge caused by the use of errhines has its source.

All excitants act by the impressions which they make upon the nervous energy. Now, as the first pair of nerves is exhausted upon the membrane covering the septum or partition of the nostrils and the turbinated bones, it is reasonably supposed to be the nerve of smelling. It does not terminate in papillæ like the gustatory nerve; but its twigs deliquesce, as it were, in the spongy pituitary membrane, and consequently render every point of it sensitive of odours. From its exposed nature rendering it liable to irritative impressions, we might, a priori, suppose that those substances which are most odorous would prove the most powerful errhines: but this is not the case; for some of the most powerful errhines are altogether devoid of odour. This is readily explained: the first pair of nerves bestows the sense of smelling; but the sensibility of the nostrils depends upon branches from the fifth pair distributed over the whole of the Schneiderian membrane, whether in the nostrils or in the sinuses where none of the twigs of the olfactory nerves extend; and it is the impression of errhines upon the filaments of the fifth pair which induces that vascular action necessary for increasing the secretion, and the consequent excretion of the mucus of the nostrils and the adjacent cavities. Pungent odours, it is true, increase the flow of the pituitary secretion; but their acrimony irritates the mucous membrane of the nose, upon the same principle as it irritates the conjunctiva, or outer membrane of the eye, when it is exposed to such odours—an effect altogether independent of the odorous principle, which is perceived through the me-

dium only of the first pair of nerves. Were the olfactory, or first pair of nerves, therefore, destroyed, as was the case in some experiments made by M. Majendie, pungent odours would still affect the nostrils, although no odour would be perceived*.

It is almost unnecessary to say that inflammation augments greatly the sensibility of the pituitary membrane; and the application of acrid matters to it, in such a state, is not only painful, but in some degree dangerous. It is, nevertheless, true that habit exerts its influence in modifying the impressions upon this organ more than upon any other; many impressions which are at first not merely unpleasant, but painful, become pleasurable by repetition, as is the case with the use of snuff; so that this and many other errhines at length, from the same cause, lose the power of exciting either vascular action or sensation. It is singular, however, that age, which renders the pituitary membrane less vascular and less sensible, should not in general diminish the secretion of the mucous follicles; on the contrary, the mucous discharge increases as age advances, and constitutes a chronic catarrhal affection, or snivelling, which is not uncommon in the last years of a long life.

Sympathy exerts a considerable influence upon the pituitary membrane. If hæmorrhage occur in it, cold applied to the skin contracts the exhaling overloaded vessels of the membrane and stops the bleeding. In inflammation of this membrane, also, fomentations applied to the face produce the happiest results; and, in some diseases of the skin—as, for example, scarlet fever in its severest form—the pituitary membrane becomes inflamed and ulcerated, and is a symptom always to be dreaded.

With regard to the nature of the discharge which the pituitary membrane secretes, and which is augmented by the action of errhines, the experiments of Berzelius have ascertained that the ingredients contained in one thousand parts

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* The want of attention to this particular led the French physiologist into an error in attributing the sense of smelling to the fifth pair of nerves.

are

Water	933.7
Mucus	53.3
Muriates of Potassa and Soda	5.6
Lactate of Soda with Animal Matter	3.0
Soda	0.9
Albumen, with a trace of Phosphate of Soda	3.5
	100.0

From this statement it appears that the chief ingredients are water and mucus; yet, in disease, the secretion is so much altered, that it becomes grey, green, and so acrid as to excoriate the upper lip; and, instead of being bland, the taste of it is then saline. That this arises from the action of the vessels, and not from any alteration in the components of the blood affording the secretion, is probable, when we reflect that the greatest changes are produced by the inflammatory process in other mucous membranes; the discharge sometimes assuming the character of pus without any abrasion of the mucous surface. In the ordinary state of health, the viscidity of this mucus seems to depend on the evaporation of the watery portion; thence, in hurried states of the respiration, the nostrils become dry and the mucus viscid and concrete.

From a knowledge of these functions of the membrane on which errhines operate, we perceive clearly that their effects result from their increasing the natural vascular action of the part within a certain limit; and we learn also that beyond that limit, instead of promoting the flow of a watery discharge from the nostrils, they tend to check it, by causing inflammation: thence the necessity for moderating the acrimony of errhines by uniting them with inert powders. We can also more readily comprehend the manner in which errhines relieve inflammatory affections of the brain, the face, and other adjacent parts, for which they are chiefly employed as remedies. And, with this knowledge, we arrive at these conclusions: 1° that errhines are stimulants acting immediately upon the sensibility and irritability of the Schneiderian membrane: 2° that they relieve inflammation in the neighbouring organs, partly by the counter irritation which they produce, causing an afflux of fluids from the neighbouring congested

or inflamed parts into the excited membrane, and partly by the permanent diminution of the quantity of the blood, caused by the augmented secretion which is induced and the continued emptying of the mucous follicles. To elucidate this position, let us suppose a case of ophthalmia, or inflammation of the eyes: there can be no difficulty in conceiving that in this case the diseased organ is as likely to be relieved by exciting an artificial discharge from the nostrils as by a blister behind the ear, or on the temples, or by any other counter-irritant.

As the first effect of several substances employed as errhines is the excitement of sneezing, I cannot, with propriety, omit noticing this result of their action before proceeding to describe the particular errhines.

The act of sneezing is produced by irritating the sensitive extremities of the branches of the fifth pair of nerves distributed to the pituitary membrane, which, by the connection of that nerve with the eighth pair, the great sympathetic and the phrenic nerves, calls into simultaneous action the diaphragm and the whole of the respiratory muscles so suddenly, after a full inspiration, as to expel the air from the lungs forcibly through the mouth and nostrils. It tends to clear the nostrils of concreted mucus, and so far may be productive of benefit. Thus, in a case which lately came within my knowledge, a lady was afflicted with violent headache, accompanied with that sensation which is well known by the term stuffing of the head. Many means tried for her relief proved ineffectual. A physician was called in, who prescribed snuff as a sternutatory: it produced violent sneezing, and ejected from one of the nostrils a plug of hardened mucus, nearly an inch in length; after which she felt immediate relief, and in twenty-four hours was perfectly recovered. In some cases, however, sneezing is productive of the most serious mischief: for instance, a young lady, in whom there was an affection of the ethmoid bone, was attacked with sneezing, arising from some accidental circumstance: in a few hours it proved fatal. Many instances, also, are recorded in which sneezing has produced immoderate bleedings from the nose, epileptic fits, and apoplexy; and, consequently,

those errhines which were formerly regarded as sternutatories are now seldom prescribed with the view of producing that effect of errhines*.

Every substance which can stimulate the mucous membrane of the nostrils may be employed as an errhine; and, consequently, numerous examples might be selected from the animal, the vegetable, and the mineral kingdoms; but a few substances only have been selected to serve as errhines, and to these it is necessary to direct our attention. They may be employed either in substance, in the state of fine powder, or in infusion or decoction, or in vapour; as in all these states the desired effect would be obtained.

TABLE OF ERRHINES.

* ORGANIC PRODUCTS.

a.—VOLATILE OIL, in combination, in				
Roots	—Iris *Florentina*	3	1	Irideæ.
Herbs	—Origanum *Marjorana*	14	1	Labiatæ.
Leaves	—Asarum *Europæum*	—	–	————
Flowers	—Lavandula *Spica*	—	–	————
	Rosmarinus *Officinalis*	—	–	————
b.—ACRID RESIN, contained in the secreted juice of				
	Euphorbia *Canariensis*	11	3	Euphorbiaciæ.
	Nicotiana *tabacum*	5	1	Solaneæ.
c. VERATRIA,—contained in				
	Veratrum *album*	23	1	Colchicaceæ.

* * INORGANIC SUBSTANCES.

d.—Hydrargyri subsulphas.

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* A singular fact connected with this subject came under my observation. A lady, liable to periodic attacks of gout, was always apprized of the approach of the paroxysm by successive fits of sneezing, which generally continued for ten or twelve hours previous to the commencement of the attack, and terminated when the pain was felt in the foot. I can account for this circumstance only by supposing, that the gouty diathesis so altered the usual state of the pituitary membrane as to render it susceptible of the impressions even of the air; and thence it is possible that, although the mucous follicles are not excited to a degree sufficient to enable them to empty their contents, yet, the passage of the air, in a highly irritable state of the membrane, may be sufficient to induce the paroxysm of sneezing, previous to the attacks of gout.

* ORGANIC VEGETABLE SUBSTANCES WHICH OPERATE AS ERRHINES.

a. VOLATILE OIL. *Oleum Volatile.*

The chemical nature of volatile oil has been already described. On account of its solubility in air, the plants containing it might be supposed to be well adapted for stimulating the pituitary membrane; but, in these, the oil is so much sheathed in bland vegetable matters, that it does not exert much influence on the secreting surface of the nostrils; and, therefore, most of these plants are better adapted as vehicles for more efficient errhines, than for exerting errhine properties themselves.

* *Roots.*

1. IRIS FLORENTINÆ RADIX. *Root of Florentine Iris.* E. —The root of the Florentine Iris, in which volatile oil exists in combination with a large quantity of fecula, is supposed to have been known to Dioscorides, because he mentions the genus Iris in his writings; and, as it is a native of Greece, it is probable that this species was that which the ancients employed. Its specific name points out the place in which it is most abundantly found in its native state. The plant to which this root belongs, the Iris *Florentina*, holds a place in the natural order Iridiæ*. It is found wild in Carniola and the island of Rhodes and Laconia; and is cultivated in our gardens.

The roots are imported into this country from Leghorn, denuded of the cuticle and of the radical fibres. They break with a rough fracture, are easily pulverized, have a sweetish, bitter taste, with some degree of pungency, and the agreeable odour of the violet. The root of this Iris, besides volatile oil, contains fecula, a portion of gum or mucus, and saccharine matter, with malic acid; and, according to the analysis of Vauquelin, a fixed oil, as well as a volatile. The latter is crystallizable.

The Errhine properties of the Iris root depend wholly

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* Woodville's Med. Bot. 3rd edition, p. 776, pl. 262. London Dispensatory, art. Iris. According to Dioscorides, the name Iris is derived from the variety of colours in the genus. "Iris a cœlestis arcus similitudine nomen obtinuit."

upon the volatile oil; none of the other ingredients it contains having any stimulating qualities. Judging, however, from the analogy of the effects of the recent expressed juice of the root of the Iris *Pseud-acorus*, which is employed by the peasantry in the south of Scotland as a sternutatory, and is very violent in its effects, we may suppose that the Florentine Iris Root, in its recent state, is also very active, and contains some acrid principle, which is dissipated in drying; and this is the more probable, as, in the recent state, the root nauseates and purges violently; neither of which effects is produced by it in the dry state. In the state in which it is brought to this country, it operates mildly; and, therefore, the pulverized root is employed merely as a vehicle for more powerful Errhines.

* * *Herbs and Leaves.*

1. ORIGANI MARJORANÆ HERBA. *Sweet Marjoram.* E. D.—This plant, which belongs to the natural order Labiatæ*, although a native of Syria, yet is now naturalized to our variable climate: it has an agreeable odour and a warm bitter aromatic taste, owing to the volatile oil which it contains. It possesses scarcely any errhine properties; and is chiefly useful as an agreeable addition to more active substances in the composition of what is termed cephalic snuff, pulvis sternutatorius.

2. ASARI EUROPŒI FOLIA. *Root of Asarabacca.* L. E. D. —Asarabacca is an indigenous plant, found in woods and shady places, flowering in May. It belongs to the natural order Aristolochiæ†. Besides volatile oil, it contains an acrid fixed oil, and a peculiar principle termed *cytissine*, which is a substance resembling an extract, of a dark yellow colour, with a bitter, nauseous taste; and attracting humidity when exposed to the air. It is very soluble in water and in weak alcohol; and nearly insoluble in strong alcohol and in ether. It possesses neither acid nor alkaline properties; neither reddening the tincture of litmus,

* Woodville's Med. Bot. 3rd edition, p. 346, pl. 124. London Dispensatory, art. Origanum.

† Woodville, p. 170, pl. 66. London Dispensatory, art. Asarum.

nor communicating a brown tint to that of turmeric. It is not precipitated by those tests which usually affect vegetable products, the acetate of lead, the nitrates of silver and of mercury, the sulphates of copper and of iron; nor by the hydrochlorates of baryta, lime, tin, and strontian. With tincture of galls it forms an insoluble compound, owing to the formation of a tannate of cytissine. Notwithstanding these negative properties, *cytissine* acts with violence on the animal œconomy, producing vomiting, purging, and inflammation of the intestinal canal. M. Chevalier, who discovered this principle in the seeds of the Laburnum, Cytissus *Laburnum*, was nearly poisoned by taking only eight grains of it; and children occasionally suffer from eating the seeds of the Laburnum.

M. J. L. Lassaigne and M. Feneulle analysed the roots of Asarabacca, and found in it—1. a concrete volatile oil, which appears to be camphor; 2. a very acrid fixed oil; 3. cytissine; 4. fecula; 5. gum; 6. ulnim; 7. citric acid, besides citrate of lime and malate of lime; 8. an acetate; 9. a salt with an ammoniacal base and some mineral salts. Several of these substances are not found in the leaves. In the decoction, persulphate of iron detects the ulmin by throwing down an olive-coloured precipitate; the gum is rendered evident by subacetate of lead; but no fecula is detected by iodine: cytissine is demonstrated to be present by infusion of galls; and the salts of lime by oxalate of ammonia. The taste and odour of the plant undoubtedly depend on the acrid fixed oil, which both tastes and smells not unlike pepper; and, on this account, although the French physicians ascribe the Errhine properties of this plant to the cytissine which it contains, yet, I am induced to believe that more is due to the volatile and acrid oils. Be this as it may, Asarabacca is a good Errhine. In the recent state of the plant, it operates too powerfully, inducing not only a greatly augmented mucous discharge from the nostrils, but very frequently a discharge of blood. It loses a considerable portion of its acrimony by keeping; but it retains enough for the purposes of an Errhine: heat dissipates the volatile oil, and alters the fixed acrid oil; on which account the plant should be dried without the aid of fire.

The recent plant has been employed as an *emetic* and a *diuretic;* but, as we possess many better substances for both of these purposes, it is used only as an Errhine*. The leaves are the part of the plant employed; the effect is not immediate, but takes place after some time has elapsed. The powdered leaves of Asarabacca form one half of a compound Errhine powder, ordered by the Edinburgh and Dublin Colleges, under the name Pulvis Asari compositus. The other parts of this compound are Marjoram and flowers of Lavender, which are only useful in giving the powder an agreeable odour. Dr. Cullen has justly remarked that Asarum is one of the most useful and convenient of the Errhines. In doses of a few grains, snuffed up the nostrils, for several successive evenings, it causes a copious watery discharge from the nostrils, which continues to flow for several days together. He prefers the Edinburgh formula for the compound powder, four grains of which he considers a proper dose.

* * * *Flowers.*

1. LAVANDULÆ SPICÆ FLORES. *Lavender Flowers.* L. E. D.—The plant yielding these flowers is a native of the south of Europe, naturalized to our climate: it is arranged in the natural order Labiatæ†. On account of the fragrancy of the volatile oil which they contain, these flowers enter into the composition of cephalic snuff.

2. ROSMARINI OFFICINALIS FLORES. *Rosemary.* L. E. D.—This plant is also one of the Libiatæ‡. It possesses excitant and tonic properties, and is sometimes prescribed, in the form of infusion, to relieve headache and hysteria. It has scarcely any errhine power; but it is an agreeable addition to cephalic snuff.

c. ACRID RESIN.

This is found in two plants, Euphorbia *Canariensis* and Nicotiana *tabacum.*

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* M. Thiebaud, of Berneaud, and M. Tenore have recognized the *Baccaris* of Virgil, which was formerly used in making crowns, to be this *Asarum:* it is found in great abundance in all the mountainous districts in Italy.

† Woodville's Med. Bot. 3rd edition, p. 321, pl. 114. London Dispensatory, art. Lavandula. ‡ Ibid, p. 329, pl. 117. London Dispensatory, art. Rosmarinum.

1. EUPHORBIÆ GUMMI RESINA. *Euphorbium.* L.—Euphorbium is the concrete proper juice of the Euphorbia *Canariensis*, a plant belonging to the natural order Euphorbiaceæ*. In the London Pharmacopœia it is improperly stated to be the product of the Euphorbia *officinarum;* for, although the proper juice of this species, as well as all the other species of this very extensive genus, is nearly the same as the officinal Euphorbium, yet that which is brought to this country is the product of the *Canariensis.*†

The plant which yields our officinal Euphorbium is, as its name implies, a native of the Canary islands. It rises with a straight, articulated, quadrangular stem, which gives off lateral, similarly jointed branches, devoid of leaves, but furnished with hooked prickles on the angles: the *officinarum* has eight or more angles; and the *antiquorum*, which yields the Euphorbium chiefly used on the Continent, has only three angles.

With regard to the manner in which the juice concretes into the forms in which it is sent to this country, there are various opinions. Bruce, in his Travels in Abyssinia, describes the *officinarum* under its Abyssinian name, Kollquall. In speaking of the flowers, which shoot out on the tops of the branches, he says, " The trees that stood thick together appeared to be covered with a cloth or veil of the most vivid crimson colour." He remarks that, on cutting two of the finest branches of a plant in full vigour, four English gallons of the milky juice issued from the cut surfaces, and made an indelible stain upon his sabre, although he immediately washed it. On striking a withered branch, the dust which flew out " seemed to threaten," he says, " to make me sneeze to death;" and touching the milky juice ex-

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* Woodville's Med. Bot. 3rd edition, vol. v, p. 74. London Dispensatory, art. Euphorbia.

† The name was bestowed on the genus in honour of Euphorbus, the physician of Juba, king of Lybia. The brother of Euphorbus, Antonius Muso, was physician to Augustus Cæsar, who raised a statue to his merits. In noticing this anecdote, Linnæus quaintly remarks on the evanescent character of the productions of art, compared with the permanency of those of Nature: " Ubi jam Musæ statua? Periit! avanuit! Euphorbii autem perdurat, perennat, nec unquam destrui potest." *Crit. Bot.* 39.

coriated his finger as if scalded with boiling water. He denies that the juice ever exudes, either spontaneously or by incisions; and, therefore, justly concludes that this is not the plant which supplies the Euphorbium for Europe.

Mr. Jackson, in speaking of one species, apparently the *antiquorum*, says, that slight incisions are made into the plant with a knife, and the juice that exudes concretes into tears of an oblong or roundish form. On examining the form of the pieces in the Euphorbium brought to this country, I am of opinion that the juice must exude spontaneously from the *Canariensis;* for it is almost all of the same form as if it had been moulded upon the capsules, which are often found embedded in the Euphorbium.

As we receive it, Euphorbium is in small, hollow, somewhat forked pieces. It is inodorous; and, when chewed, feels at first nearly insipid, but it soon impresses a hot sensation to the mouth, and gradually gives to the tongue, the palate, throat, and pharynx, an acrid or burning feeling, which is almost insupportable. When retained for some time in the mouth and masticated, it inflames, corrodes, and ulcerates.

Euphorbium is mentioned in the London Pharmacopœia as a gum resin; but chemical analysis has demonstrated that it contains no gum. It has been analysed both by Braconnot and Pelletier, who have found the same substances; but have stated very different quantities. The products of the analysis and the quantities given by each are—

	Braconnot.	Pelletier.
Resin	37.0	60.80
Wax	19.0	14.40
Malate of lime	20.5	12.20
——— of potassa	2.–	1.80
Woody matter and bassorine	13.5	2.00
Water and volatile oil	5.0	8.00
Loss	3.–	—.80
	100.0	100.0

When alcohol is poured over powdered Euphorbium and boiled and filtered, a quantity of wax is deposited on cooling, and what remains in solution is RESIN. The wax, when well washed with alcohol, is insipid; the resin is acrimonious

and burning when applied to the tongue. The insoluble residue, when acted upon with pure water, independent of waste from morsels of wood and other extraneous bodies, is mostly malate of lime. The resin is slightly deliquescent, owing to its containing malate of potassa, which can be separated from it by boiling it with distilled water. The pure resin is transparent, reddish, and is idio-electrical when rubbed. The resin is the active part of these components. This resin is insoluble in alkalies, but soluble in sulphuric and nitric acids; thence differing from most of the other resins.

Euphorbium, applied to the skin or to the mucous membrane, quickly produces the most painful and violent irritation. It is so acrid, that those who pulverize it are obliged to defend the nostrils, the eyes, and the mouth. I shall have a future opportunity of explaining the effects of Euphorbium when taken into the stomach. Orfila, who made numerous experiments on dogs with it, found that, by applying it to the thigh of a dog denuded of the cuticle, it produces so intense an inflammation, both of the part itself and of the adjacent parts, as to cause death; but, on opening the body, neither the lungs nor the primæ viæ presented any marks of having suffered. It is a powerful Errhine, but requires to be largely diluted with some bland powder. When thus diluted largely, either with starch or with liquorice root powder, it operates effectually and beneficially.

2. NICOTIANÆ TABACI FOLIA. *Tobacco.* L. E. D.— Tobacco, as has been already stated (vol. i, p. 437), owes its efficacy to acrid oil, in combination with a peculiar alkaline principle named *Nicotina*, which was discovered by Vauquelin in 1809.

Every part of Nicotiana *Tabacum* is acrid, and contains the active principles for which the leaf is prized.

In Virginia the Tobacco is gathered before it flowers, when the leaves have attained their full size, and have a dark green colour, and feel crisp. The plants are cut over at the surface of the ground, and suspended under an open shed, two and two, tied together, but sufficiently apart from each other, so as not to touch. In this state they remain till the

leaves are perfectly dry; when, stripped from the stalks, they are tied in small bundles, a leaf serving to tie them together. These bundles are then laid in heaps in sheds, to favour a fermentation, which takes place in them: to forward it still more, the heaps are covered with blankets or layers of straw; and, to prevent them from overheating, they are occasionally opened and spread abroad in the air. As soon as all danger of overheating is past, the bundles are packed in casks for exportation to Europe. As we receive them, Tobacco leaves have a brownish-yellow colour; a strong and not very agreeable odour; and a bitter, very acrid taste. When burned, they emit sparks, and continue to burn in the same manner as paper which has been soaked in nitrate of potassa; on which salt, indeed, the deflagration of Tobacco depends. Distilled, without the addition of water, they yield a green volatile oil, which is a virulent poison. At the Cape of Good Hope and Van Dieman's Land, this oil, which accumulates in the tubes of old smoking pipes, is employed for killing snakes. "A Hottentot," says Mr. Barrow, "applied some of it, from the short end of his wooden tobacco pipe, to the mouth of a snake, while darting out his tongue. The effect was instantaneous as an electric shock: with a convulsive motion that was momentary, the snake half untwisted itself, and never stirred again; and the muscles were so contracted that the animal felt hard and rigid, as if dried in the sun." Tobacco yields its properties to water and to alcohol. The expressed juice of the fresh leaves were analysed by Vauquelin, and found to contain a considerable quantity of vegetable albumen or gluten; supermalate of lime; acetic acid; nitrate and muriate of potassa; a red matter, soluble in alcohol and water, which swells considerably when heated, but the nature of which is yet unknown; muriate of ammonia; and a peculiar, acrid, volatile, colourless substance, which has the odour of Tobacco, and is the principle which distinguishes Tobacco from every other vegetable product, the *Nicotina*. Some of these principles are detected in infusion of Tobacco by reagents: thus, the gluten is precipitated by infusion of gall nuts; oxalate of ammonia decomposes the supermalate of lime, and throws down an insoluble oxalate of lime; and

that the salt thus decomposed is a malate, is proved by the persulphate of iron precipitating the infusion brown, this precipitate being a malate of iron.

The history of the introduction of Tobacco into Europe, and its use as a luxury, is so curious and interesting, that I will make no apology for presenting a brief sketch of it.

There is no record of the period when Tobacco was first used in South America. Humboldt says it has been cultivated from time immemorial by the natives of the Oroonoko; and it was smoked over all America at the time of the Spanish conquest. It was also used in the religious ceremonies of the Indians; the smoke of a few Tobacco leaves thrown upon the fire produced the same effects on the officiating Piachè as the mephitic vapours on the Pythean priestess at Delphos; the smoke was received into the open mouths of the priests, who thus became intoxicated, and fitted to utter the mystical jargon which was regarded as oracles by the misguided multitude.

Tobacco was found by Cortes in use in Yucatan, in 1519; but it had been seen smoked on the occasion of an amicable interview between Grisalva, a Spaniard, and the Cazique of Tabasco, which took place in the previous year. In Asia, where it is now an almost absolute necessary of life, it was unknown until after the discovery of America. It was first sent to Europe, to the court of Portugal, by Hernandez de Toledo, in 1559; and Jean Nicot, being then the French ambassador at the court of Lisbon, having sent some of the seeds to Catharine de Medicis, they grew; and the plant was named Herba Reginæ: it was, however, afterwards called Nicotiana, after *Nicot*. The specific name, *Tabacum*, according to some, is derived from the name of the place where it was first found; according to others, from Tabac, the name of the instrument or reed used by the Americans in smoking the leaf: but it is more probable that it was named from Tabasco,* the place where the Spaniards first saw it smoked.

Although Linnæus honoured Nicot with the generic name of the plant, yet some of the species are said to have been discovered in the island of St. Domingo, before

* Tabasco was indiscriminately called Tabaco.

1518, by a Spanish hermit, Roman Panè. It was cultivated before 1580, in Spain, France, Italy, and Portugal. It was introduced into England by Sir Walter Raleigh, who certainly, by his example, and that of his crew, brought smoking into use; and it became soon very prevalent. It had, however, a royal opponent in James the First, who published a philippic against it, "The Counterblaste to Tobacco," in which he remarks that smoking is a custom "loathsome to the eye, hatefull to the nose, harmefull to the braine, dangerous to the lungs; and, in the blacke stinking fume thereof, neerest resembling the horrible Stygian smoake of the pit that is bottomless:*" a sentiment in which, although some might accord, yet from which many would strongly dissent. The same monarch proposed as a banquet for the devil, a loin of pork, and a poll of ling and mustard, with a pipe of Tobacco for digestion: he endeavoured to abolish its use by a heavy penalty, and enacted that no planter in Virginia should cultivate more than 100lbs of it: but the advantage derived to his revenue from its importation soon produced the abolition of these restrictions. An edict had been previously published against its use in the time of Elizabeth, in which the reason for prohibiting it is stated to be a fear lest Englishmen should become like the barbarians from whom its use was derived—"Anglorum corpora in barbarorum naturam degenerasse, quum iidem ac barbari delectentur.†" But it was not in England alone that war was waged against this American herb: in the 16th century (1590) Shah Abbas prohibited the use of Tobacco in Persia; but, as the punishment was penal, many of his subjects, rather than discontinue smoking, fled to the mountains: in 1624, Urban VIII excommunicated all snuff-takers who committed the heinous sin of taking a pinch in church; in 1653 all smokers in the Canton of Appenzel were cited before the council and punished: in the year 34 of the same century, the Russians, whose peasantry now smoke all day long, were forbidden to smoke under the penalty of having the nose cut off: and Amurath VII also

* Apophthems of King James, 1671.

† Annal. Eliz. p. 143.

rendered it a capital offence. In Russia, indeed, the animosity against the use of Tobacco, in any form, was so great, that a particular tribunal was instituted for punishing smokers, the Chambre au Tabac: it was not abolished until the middle of the 18th century. So late as 1690, Innocent XII excommunicated all who took snuff in St. Peter's church; and, in Constantinople, where the use of Tobacco, in every form, is now as common almost as eating, every Turk who was found smoking was conducted in ridicule through the streets, with a pipe transfixed through his nose and seated on an ass with his face towards the tail; one reason for which was, that it was supposed the use of Tobacco rendered the men impotent; and, certainly, if taken in excess, such a result is likely to follow from its use. But, like many other bad customs, Tobacco triumphed over all its opponents; and it has become almost universal, not only in Europe, but even in the islands of the Pacific, where it was introduced by Europeans, its use is carried to the most ridiculous excess. "In the Sandwich Islands," says Kotzebue, in the narrative of his Voyage of Discovery, "it is so generally used, that children smoke before they learn to walk; and grown-up people have carried the practice to such an excess, that they have fallen down senseless, and often died in consequence."

But if smoking be carried to an excess, snuff-taking is still more so*. Nothing would be more curious than a collection of snuffs from various parts of the world; and their history would form a singular specimen of the ingenuity idly exercised in varying the form and quality of a powder intended for the titillation of one set of nerves. The snuffs of this country, like the varieties of sheep and of geraniums, may all be regarded as proceeding from one stock; or, as cross breeds, if the term can be tolerated, from the Rappé, which is nothing more than snuff ground from all the Tobaccoes that are grown, mixed together and fermented. Rappé derives its name from having been originally produced by

* An amusing fact, connected with the opposition to the general use of Tobacco, is related of Fagon, physician of Louis XIV. In the midst of an oration on its pernicious effects, the orator made a pause, and, taking his snuff-box from his pocket, refreshed himself with a pinch, to enable him to renew his argument.

rasping what is called Carrot Tobacco ; that is, the leaves of tobacco freed from its stems, fermented, and pressed closely together into the form of a carrot, or rather spindle.

Scotch snuff, which is also the basis of many varieties of snuffs, is ground from Tobacco, with the stalk left on the leaf: it is first fermented, then dried before a strong fire, and afterward ground in mills, resembling a large pestle and mortar. It would be impossible to mention one half of the snuffs in use. In the manufacture of snuff, it has been asserted that salt, urine, sal ammoniac, and even ground glass, are added to the Tobacco: but I am informed by a large manufacturer that nothing of the kind is employed, and that all depends on the preparation of the Tobacco leaves, by drying, and the degree of fermentation which they have undergone.

Upon the animal œconomy, Tobacco operates as a local stimulant to whatever part it is applied; even in a small quantity, it excites the action of the living powers. Applied to the petuitary membrane, it augments the flow of mucus, on those principles which, as I have already explained, regulate the action of Errhines. Its local effects on the salivary glands and the stomach, although of the same nature, do not at present demand our attention: but I may mention that, applied externally, it causes inflammation in parts susceptible of it. Like other stimulants, however, the repetition of the impression diminishes the sensibility and irritability of the part to which it is applied. Thus, snuff-takers lose the susceptibility of impression on the Schneiderian membrane, and therefore are forced to increase the power of the stimulant by increasing the quantity snuffed up at once, as well as the frequency of its application.

Snuffing is the most frequent and the least injurious mode of using Tobacco; although, in those unaccustomed to it, it causes nausea and vertigo. In great snuffers the stomach frequently suffers; dyspeptic symptoms supervene, accompanied with pains and a sensation of twisting in the bowels—effects which may result from the snuff passing into the pharynx and being swallowed ; although it is also possible that they may proceed from sympathy. Instances daily occur in which quantities of snuff is coughed up by great snuff-takers ;

and Dr. Alston says that some persons have thrown up balls of snuff*. It is generally injurious in weak and what are termed nervous subjects; and some practitioners, among whom is the celebrated Lorry, has ascribed the more frequent occurrence of nervous diseases to the daily excessive taking of snuff. Upon the whole, however, it is probable that the statements respecting the baneful effects of snuff, are, at least, greatly exaggerated. In the manufactories of snuff in France, in which upwards of 4000 persons are employed, it has been ascertained that the workmen become habituated to the atmosphere of the manufactory; that they are neither subject to special diseases, nor to disease generally; and that they live, on an average, as long as other tradesmen.

Tobacco, as we have described it, has been considered only as an article of luxury. As an Errhine, it has been used in epilepsy supposed to proceed from a full or plethoric state of the vessels of the head. From the quantity of fluid discharged, a depletion of the whole of the vessels of the head is supposed to result: but, from its narcotic property, it ought to be employed with caution, and not at all when there is any tendency to apoplexy. We certainly, sometimes, see great snuff-takers seized with apoplexy and palsy, when they suddenly leave off the use of snuff. From its narcotic properties, also, it is certainly less proper than some other substances as an Errhine: and, independent of these qualities, it has this disadvantage as an Errhine, that its effects are very transient. Upon the whole, it is a much less valuable Errhine than several of the substances which we have already described.

c. VERATRIA.

This alkaline principle, discovered by Pelletier and Caventou, has been already described in vol. i, p. 595.

Veratria is procured from the seeds of at least two species of Veratrum, the *album* and the *sabadilla;* and also from the bulb of the Colchicum *autumnale.* It exists in greatest quan-

* In the Counterblaste already quoted, we find the following sentence on this subject—" It makes a kitchen, also, oftentimes in the inward parts of man, soyling and infecting them with an unctuous and oily kind of soote, as hath been found in some great Tobacco takers, that after their death were opened."

tity in Veratrum *sabadilla*. It may be readily procured by precipitating a decoction of the seeds of the Sabadilla by means of acetate of lead, filtering, and washing well the precipitate on the filter with distilled water. These washings and the filtered solution united are next to be treated with sulphuretted hydrogen, to separate any acetate of lead which it may retain in solution, and again filtered. The solution now contains only an acetate of Veratria. To decompose this salt, the solution must be boiled with magnesia, which unites with the acid, leaving the insoluble Veratria to be precipitated with the excess of magnesia. This precipitate, collected on the filter, is to be well washed with distilled water, dried, and then treated with boiling alcohol, which takes up the Veratria, and leaves the magnesia. The Veratria is obtained partly by precipitation on the solution cooling, partly by evaporation.

As an Errhine, Veratria possesses most energetic properties; an almost imponderable quantity applied to the nostrils provokes the most violent sneezing. In small doses, internally administered, it vomits and purges violently, acting first locally on the mucous membrane, and then generally through the nerves. It is a virulent poison. In combination with gallic acid, it is the active principle of the following root.

VERATRI ALBI RADIX. *Root of White Hellebore.* L. E. D. —This plant is the ελλεβορος λευκος of the ancients. The name Hellebore has led to some doubts respecting the plant; but, from the testimony of Celsus, it is evident that two species of Veratrum were employed by the ancients. Speaking of insanity, he says, "In tristitia, nigrum Veratrum objectionis causa; in hilaritate, album ad vomitum excitandum dari debet*."

The genus Veratrum belongs to the natural order Colchiaceæ.† It grows abundantly on the mountains and elevated pasturages of the south of Europe; on the Alps, the Pyrenees, the mountains of Jura and Auvergne, and those

* De Med. lib. iii.

† Woodville's Med. Bot. 3rd edition, p. 753, pl. 257. London Dispensatory, art. Veratrum.

of Greece. It is sometimes cultivated in the gardens of this country.

The root in its recent state has a strong, unpleasant odour, which is lost in drying. The taste is at first soft, then bitter, and at length acrid and corrosive. When light and spongy, the roots are bad: they are sometimes adulterated with the roots of asparagus; which, however, are easily distinguished, from the conical form and compactness of the roots of the Veratrum, and likewise by the absence of the acrid taste in those of asparagus. M. Pelletier and Caventou analysed this root, and ascertained its components to be—a fatty matter and a volatile acid, forming a fatty compound; a yellow colouring matter; fecula; gum; and an acidulous gallate of Veratria. Of these principles, four are inert as far as its errhine qualities are concerned, and two active—the volatile acid and the gallate of Veratria. When the root is incinerated, it yields carbonates of potassa and of lime, sulphate and phosphate of lime, and silica. I am disposed to doubt the existence of a gallate, particularly an acidulous gallate; as neither the sulphates of iron nor nitrate of silver are affected by infusion of Veratrum.

Veratria, as I have already said, stimulates powerfully the mucous membrane wherever it is applied, producing inflammation; and, although absolutely inodorous, yet, if the smallest quantity be carried into the nostrils, it causes sneezing so violent as to become dangerous. We see, in these properties of this substance, a proof—that it is the presence of the Veratria in the root of the white hellebore which gives it Errhine properties; and we possess the means of making a certain Errhine, always of the same strength, by combining Veratria with a portion of starch sufficient to soften down or cover its acrimony. In the powerful action of an inodorous substance, also, when applied to the nostrils, we have a demonstration of the fact, that the action of Errhines is not exerted upon the olfactory nerves, but upon those of the fifth pair, on which the irritability of the mucous membrane depends. Even when involved in the other components of the roots of Veratrum, the Veratria is so acrid as

to require farther dilution before it can be employed with safety; the powdered root, therefore, is mixed with three parts of starch, or with the powder of liquorice root, for Errhine purposes. Three grains of it, diluted with nine grains of starch, snuffed up the nose for three successive evenings, generally produce a copious watery discharge from the nostrils. Great caution is required not to apply it to an ulcerated surface; for, besides producing griping and purging, and other poisonous symptoms, the ulceration assumes a phagedenic character.

INORGANIC SUBSTANCES WHICH OPERATE AS ERRHINES.

SUBSULPHATE OF MERCURY. *Subsulphas Hydrargyri flavus.* E. *Sulphuricum Oxydum Hydrargyri.* D.—This salt is prepared by boiling three parts of sulphuric acid on two parts of pure mercury, until the whole is dissolved: by afterwards continuing the heat until the acid is partially decomposed, the sulphate is converted into a bisulphate. If too little heat be employed, this decomposition is not effected; and the subsequent steps of the operation are not such as are desired. Boiling water is next poured upon the bisulphate: it acts by a powerful affinity for sulphuric acid, and, decomposing the salt, abstracts the greater part of the acid, precipitating the subsulphate of a bright yellow colour. When the heat is not continued until the whole is perfectly dry, besides the precipitation of the yellow subsulphate, the water holds in solution sulphuric acid and a portion of supersulphate, and waste is the consequence.

This subsulphate, which is the Turbeth mineral of the old chemists, when well prepared, is inodorous and acrid. Its sp. gr. is 6.444; it is nearly insoluble in water, requiring 2000 parts for its solution. Its constituents are 15.0 of acid; 84.7 of peroxide; or 1 prop. of sulph. acid $= 40, + 1$ of peroxide of mercury $= 216$; equivalent 256.* It is an ex-

* That it is a subsulphate is proved by exposing it to the action of a solution of pure potassa, which unites with the sulphuric acid, and leaves the peroxide of a brownish-yellow colour. If the solution be separated, acidulated with nitric acid, and tested with nitrate of baryta, the presence of the sulphuric acid is readily detected by the formation of sulphate of baryta.

tremely useful Errhine, and possesses the property of being always of the same degree of strength. It requires to be sheathed with five parts of starch or any farinaceous powder; a dose of which, containing one grain of the subsulphate and five of starch, snuffed up the nostrils, generally produce a discharge which continues for several days. It has been found very useful in ophthalmic affections; and, as it possesses no narcotic power, there can be no doubt that it is superior to every other Errhine in affections of the head.

Therapeutical Employment of Errhines.

The first use of Errhines is to increase the natural mucous discharge of the nostrils when this is deficient; and here we can always depend on them: their secondary effects are not so certain. In chronic affections of the conjunctiva they prove useful: but in amaurosis, in which they have been extolled, I have never seen any advantage derived from them: indeed, when we reflect upon the variety of causes that produce this affection of the optic nerve, we can scarcely wonder at their failure. In that species of the disease, however, which Sauvage describes under the name of Amaurosis *plethorica*, which, in particular, sometimes affects females labouring under suppressed catamenia, or proceed from transitory congestions, they may prove useful. Deafness arising from some states of the Eustachian tube, as, for instance, thickening of its lining membrane, has been relieved by the use of Errhines. The celebrated Boyle reports a case of absorption by the counter-irritation of Euphorbium as an Errhine; but little weight can be given to any solitary case. Errhines have been recommended in chronic affections of the head, of a rheumatic character; but there are preferable remedies, which supersede their employment in such diseases. The complaints in which they are most evidently beneficial are headache, connected with a debilitated frame of body. In these cases their stimulant properties are beneficial, while at the same time, by the discharge which they solicit, they prevent congestion from occurring in the weakened vessels of the brain. Upon the whole, Errhines are not remedies of much power, and consequently are seldom prescribed.

SECTION XI.

SIALAGOGUES.—MEDICAMENTA SIALAGOGA.

Syn.—Salivantia. Apophlegmatismata.

THE term Sialagogues is derived from the Greek words *σιαλος*, saliva, and the verb *αγω*, I lead forth. Sialagogues are " medicines which increase to a considerable degree the excretion of the saliva, and cause it to be discharged in a thinner state than usual." Besides increasing the discharge of the salivary glands, they also greatly augment the excretion from the mucous follicles of the mouth and fauces; operating as local stimulants when topically applied to the excretory ducts of the salivary glands and to those of the mucous follicles. The mucous membrane of the mouth produces, independent of the secretions of the salivary glands, two distinct fluids—one, albuminous and aqueous, which it exhales; the other, a mucous fluid, which is secreted in numerous follicles seated in the substance of the membrane. These follicles have the characters of glands, and pour out unceasingly, through imperceptible orifices, the mucus which lubricates the mouth, and supplies to its surface the place of the epidermis on the skin, operating as a defence against the too powerful action of substances taken into the mouth on the nervous fibrillæ. These glands are apparent in the palate; they have a roundish form and a covering of cellular membrane. When cut into, they appear vascular, and are penetrated by nervous fibrils, twigs of the ganglionic portion of the third division of the fifth pair of nerves, which furnish sensibility to the mouth, independent of the function of taste. There are three orders of salivary glands. The *parotids*, which occupy the hollow between the mastoid process of the temporal bone and the angle of the lower jaw, betwixt the ear and the jaw, immediately over the massiter

muscle, stretching up towards the zygomatic process. The surface of these glands is unequal, from their being composed of lobules, united by a cellular membrane. Each lobule is supplied with an excretory duct, which passes into a common trunk; which, beginning near the upper part of the gland and piercing the buccinator muscle, opens upon the lining membrane of the cheek, opposite to the second or third molar tooth. It is supplied with blood vessels and nerves; and when exciting substances are taken into the mouth, the stimulus is communicated from its orifice to each glandular lobule: an increased secretion of saliva is the result; and this is poured through the secondary ducts into the trunk, or, as it is termed *duct of steno*, and thence into the mouth.

The next glands secreting the saliva are the *submaxillary;* they are of an irregular oval form, lie under the lower jaw, over the tendon of the digastric muscle, and generally involve the facial artery as it passes over the lower jaw. The ducts of these glands, like those of the parotids, form common ducts, which have been named Whartonian, and open on each side of the fræenum, or bridle of the tongue, near the gums of the incisor teeth. When these ducts are excited by any stimulating or acrid substance taken into the mouth, they become erected, and their open mouths are seen distinctly: in this state they pour out freely the saliva secreted in the glands.

The glands of the third order, from their position under the tongue, are termed *sublingual*, and are separated from the mouth only by its lining membrane. They open by small lateral ducts, the Rivinian, upon the lower surface of the tongue.

From these glands the saliva is poured out, to the amount, according to the statement of Nuck, in his *Sialagraphia*, of a pound in twelve hours; but, as this is swallowed, the calculation of Nuck must be regarded as arbitrary. The quantity is greatly augmented by stimuli, whether corporeal or mental. The saliva in its natural state is a watery, somewhat viscid fluid, insipid, inodorous, and consisting of the following constituents:

Water	992.9	
A peculiar Animal Matter	2.9	or seven parts of solid contents in 1000.
Mucus or Albumen	1.4	
Alkaline Muriates	1.7	
Lactate of Soda	0.9	
Pure Soda	0.2	
	1000.0 *	

When mixed with distilled water, a flaky matter subsides. Besides the salts noticed by Berzelius, permuriate of iron detects the sulpho-cyanate of potassa; muriate of baryta, a sulphate; and subacetate of lead, a carbonate. According to Tiediman and Gmelin, the solid matter in saliva is $\frac{1}{25}$th per cent.; the soluble salts in it are acetate, phosphate, sulphate, hydrochlorate, and sulpho-cyanate of potassa; the insoluble salts, the phosphate and carbonate of lime, and a minute portion of magnesia. Some physiologists imagine that the three glands afford each a different kind of saliva; and that, as the sublingual glands greatly resemble the mucous glands, the fluid furnished by them is a modification of the common mucous of the mouth.

During mastication, the excretion of saliva is certainly greater than might, a priori, be suspected. In a case of wounded œsophagus, Dr. Gairdener asserts that from six to eight ounces were discharged during a meal.

Besides the saliva, the mucus of the labial and bucal glands, and that also of those of the tongue, is poured into the mouth and mixes with the saliva; and it is the combined action of these on the food during mastication which prepares it to be acted on in the stomach by the gastric juice. Thence the necessity for a due supply of this fluid; and the care which Nature has taken to secure it by not entrusting it to one organ.

Now, such being the nature of these glands, and the orifices of their excretory ducts being irritable, the mode of action of Sialagogues is readily understood. They are taken into the mouth and masticated; by which means their acrid and other stimulating components are separated and dissolved in the saliva and mucus: in this state they stimulate

* Berzelius.

the orifices of the salivary ducts ; the excitement is extended to the glands and *their* vessels, in a manner analogous to the action of Errhines on the pituitary membrane, and the same result follows. The impetus of the blood vessels passing into the glands being augmented, a greater quantity of blood is carried through them in a given time ; the quantity of the natural secretion is thus greater in proportion to the supply of blood ; and the excretories being full, and at the same time stimulated to exert their proper function, a greater quantity of saliva is poured into the mouth. The *thinness* of the fluid which is excreted from the glands, under the influence of Sialagogues, is in part owing to the hasty and imperfect manner in which it is secreted ; partly, when the quantity is great, from its not being long enough retained in the mouth to permit the absorption of the aqueous part, and consequently its natural inspissation does not take place. It must, however, be also recollected that all *direct* Sialalogues are masticated, and that this process produces an increased flow of the saliva ; the preternatural flow, therefore, is owing partly to mastication, partly to the stimulating qualities of the substance employed as a Sialagogue. The influence, however, of the masticatory process, or movement of the jaws, is combated by Borden and others ; who deny that the parotids are compressed in the movement of the jaws, and maintain that such compression would rather impede than promote the secretion and excretion of the saliva. Indeed, if we consider the effect of speaking on the secretion and excretion of this fluid, we shall then be satisfied that little results from the mechanical pressure which is supposed to attend the movement of the jaws. That stimulants are necessary to produce the flow of the salivary glands, experience has taught to Asiatic nations, who employ masticatories daily, consisting of a mixture of the Piper *betel*, tobacco, quicklime, and the leaves of the Areca *catechu*.

Sialagogues, by this superabundant discharge of the natural secretion, exert some influence on the whole of the carotid system of vessels, and thence on those generally of the habit, and diminish the quantity of the circulating fluid in a degree equal at least to that of some other evacuants.

This is rendered evident by the emaciation which follows the continued use of Sialagogues. It is not necessary to their effect that any of the substances employed should be taken into the stomach; their immediate operation, therefore, extends only within a limited sphere.

As all Sialagogues are acrid matters and influence the nervous energy, they cause pungent sensations on the organ of taste; and it is not improbable that some part of their influence, as remedial agents, depends upon this impression. It is indeed only upon this principle of action that we can explain their efficacy in paralysis of the tongue and other argans of deglutition; for although the motor nerves are those chiefly affected, yet those of sensation are always, also, in fault in cases in which stimulant masticatories are likely to prove serviceable.

It is curious to remark, in this effect of Sialagogues, the force of habit, in changing sensations which are at first highly disagreeable and even painful, into those which are pleasurable. Thus, the use of tobacco, as a masticatory, is at first nauseating and painful; but, by continued use, it becomes at length so agreeable as to be prized as a luxury, and in many instances is regarded almost as a necessary of life. Like opium, it seems to invigorate the frame and to rouse the corporeal strength to extraordinary exertion. To those unaccustomed to the stimulus of tobacco, the privation of it is an evil which can only be appreciated by those who have felt it. An anecdote which an old man, who was a collector of furs in North America, detailed to me, is highly illustrative of this fact. He had lost his way in the woods, and had not tasted food for two days, when he met with a party of Indians, who, like himself, had been unsuccessful in the chase. As they had no food, he requested, as the next greatest favour that could be granted to him, a small quantity of tobacco; but there was only one quid remaining in the party, and that was already half masticated. A man, however suffering under hunger and fatigue is not nice: he begged it so earnestly, that the Indian took it from his mouth, and, dividing it, gave him one half; he received the gift thankfully; it recruited his exhausted powers, and, to use his own language, "pre-

served his life by supporting him until he reached his quarters and obtained some substantial nourishment."

Sialagogues, properly employed, produce salutary effects; and these are extended to the œsophagus, the air tubes of the lungs, and even to the stomach. Thence Sialagogues are administered successfully in rheumatism of the throat and the jaws; in toothache, in chronic cephalalgia, lethargy, in a tendency to apoplexy, and in similar affections. They are also daily employed in paralytic affections of the tongue; and to restore and maintain the cohesive power of the fibrous tissue of the gums, in a spongy state of these parts. Upon the whole, however, they are seldom employed. As far as paralysis is concerned, it is only in the local state of the disease that they can prove beneficial; and certainly this is a form of paralysis which is comparatively rare.

TABLE OF SIALAGOGUES.

a. VOLATILE OIL—contained in—			
Cochlearia *Armoracia*	15	1	Cruciferæ.
Acorus *Calamus*	6	1	Aroideæ.
b. FIXED ACRID OIL—contained in—			
Anthemis *Pyrethrum*	20	2	Compositæ.
Nicotiana *Tabacum*	5	1	Solaneæ.
c. ACRID RESIN—contained in			
Zingiber *officinalis*	1	1	Scitamineæ.
Daphne *Mezereum*	8	1	Thymeleæ.

SUBSTANCES WHICH OPERATE AS SIALAGOGUES.

a. VOLATILE OIL. *Oleum Volatile.*—The nature and chemical properties of Volatile Oil have been already sufficiently explained (vol. i, p. 180). It is in its natural combination with other vegetable components that it is employed as a Sialagogue. Why it is not used for this purpose in its uncombined state I am not aware; as it is well known that Volatile Oils, applied on cotton in toothache, augment greatly the flow of the saliva.

1. Cochleariæ Armoraciæ Radix. *Horse Raddish.* L. E. D.—This species of Cochlearia, a native of Brittany and other parts of France, is extensively cultivated in this country. It belongs to the natural order Cruciferæ*. The plant is an annual, but the root perennial and viviparous; so much so that it is difficult to eradicate it from grounds. The root is employed as a Sialagogue in the recent state, as it loses much of its acrimony by keeping. It has been used in paralysis of the tongue; but is very seldom prescribed as a Sialagogue.

2. Acori Calami Rhizoma. *Sweet Flag.* L. E.—This Rhizome, as has been already stated (vol. i, p. 194), owes its properties also to an essential oil, which is readily procured in a separate state; and, if combined with starch in the form of a lozenge, might be advantageously employed as a Sialagogue. The Rhizome, however, is preferred; but it is rarely used.

FIXED ACRID OIL.

In denoting fixed oil as an acrid substance, adequate to stimulate the salivary glands and operate as a Sialagogue, it is necessary to state that the fixed oil may be merely the vehicle of the acrid matter, which, it is probable, exists as a distinct principle. The combination, however, is so complete, that the latter has never been procured separate from the the former; and consequently the appellation *acrid fixed oil* is fully authorized.

1. Anthemis Pyrethri Radix, *Pellitory Root,* L. E. D. has also been already noticed as an excitant; and its properties demonstrated to depend on an acrid fixed oil, which M. Gauthier discovered in it, in combination with volatile oil, gum, inulin, and muriate of lime†. It is to this fixed oil that we are to ascribe its Sialagogue effects. It impresses a peculiar pricking sensation on the tongue, which is not very perceptible at first, owing to its little solubility; but it soon increases and excites salivation. The root has been long employed as

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* Woodville's Med. Bot. 3rd edition, p. 400, pl. 145. London Dispensatory, art. Cochlearia.

† Journ. de Pharmacie, 1818, p. 33.

a Sialagogue, and has been more relied upon than any other in paralysis of the tongue and the organs of deglutition.

2. Nicotianæ Tabaci Folia. *Tobacco.* L. E. D.—From what was formerly said respecting Tobacco and its chemical constituents, it is scarcely necessary to state, in mentioning it as a Sialagogue, that, although its primary action be stimulant, and it is thereby calculated to increase the flow of the saliva, yet it exerts also a narcotic influence, and therefore requires to be employed with caution; and, that particular care should be taken not to swallow the saliva. This is a circumstance less likely to occur when the Tobacco is chewed by one unaccustomed to its use, as the nauseous taste tends greatly to prevent the saliva from being swallowed; the narcotic influence, therefore, of the Nicotina on the heart and arterial system is only partially felt. I have said the *Nicotina;* for I am of opinion that it is this principle which is separated by the action of the saliva in chewing; and, although this ought not to be swallowed, yet much less mischief is likely to result from its entering the stomach, than from the volatile oil which is separated in smoking, and which, as I have already stated, acts more directly on the nervous energy than the Nicotina, exciting convulsions and coma, without affecting the heart, whilst the Nicotina displays its influence chiefly on the heart and arteries. Now, when Tobacco is chewed to relieve toothache, an effect which almost invariably follows its employment as a Sialagogue, the acrid oil which it contains stimulates powerfully the salivary glands and their excretory ducts; and something is due to the increased discharge from the salivary glands; but the relief from pain is doubtless owing to the sedative effects of the Tobacco; and, on this account, we find that relief is more rapidly procured from smoking than from chewing. The first effect in both cases, on those unaccustomed to the use of the plant, is transient excitement, with an accelerated pulse, which is followed by collapse, displaying giddiness, fainting, and sickness, accompanied with a weak, quivering pulse, and not uncommonly some degree of somnolency. Gmelin has recorded two cases of death from excessive smoking; but in one of these cases seventeen pipes, and in the other

eighteen pipes were smoked at one sitting. Few accidents, however, except in peculiar idiosyncracies, are likely to occur from Tobacco used as a Sialagogue.

Tobacco, when used as a Sialagogue, should be in that state in which it is prepared for the purposes of chewing, which is done by merely freeing the leaf from its midrib, moistening it and rolling it up, by the aid of a machine, or, as it is termed, spinning. It is contraindicated as a Sialagogue in cases of paralysis of the organs of deglutition.

ACRID RESIN.

Pure Resin is insipid and inodorous: it is therefore probable that the Acrid Resin to which the activity of the two following Sialagogues is due, is a compound of Resin and a distinct acrid principle; but, as there are no means of separating these substances, this opinion must be regarded as conjectural.

1. ZINGIBERIS OFFICINALIS RADIX. *Ginger.* L. E. D. —The Acrid Resin in Ginger is involved in a large quantity of fecula: it acts powerfully on the nerves of the mucous membrane; and, therefore, possesses Sialagogue powers. It may be advantageously employed in paralysis of the tongue and the muscles of the gullet; but, for the reasons which were formerly stated (vol. i, p. 198), the saliva ought not to be swallowed by those afflicted with stricture of the urethra.

2. DAPHNES MEZEREI CORTEX. *Mezereon Bark.* L. E. D.—The Mezereon, or Sponge Olive, is an indigenous plant, belonging to the natural order Thymeleæ*. The bark of every part of this plant contains an acrid resin, which appears to owe its acrimony partly to acrid resin, partly to a peculiar principle, which may be separated from the resin. Vauquelin discovered this principle in 1808, and named it *Daphnine*†. It is procured by digesting the bark in alcohol, evaporating the tincture to the consistence of syrup, then mixing the residue with water. The resin is

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* Woodville's Med. Bot. 3rd edition, p. 717. London Dispensatory, art. Daphne.

† Ann. de Chim. tome 86, p. 174.

precipitated and the Daphnina dissolved in the water: the solution, after filtration, is to be precipitated by acetate of lead; and the precipitate being suspended in water and freed from any lead by means of sulphuretted hydrogen gas, what remains in solution is the Daphnina. On evaporation it crystallizes in small, prismatic, colourless, brilliant, transparent crystals, very soluble in hot water, from which, however, they are deposited on cooling; very soluble in alcohol, and acquiring a yellow colour on the addition of a little solution of potassa or its carbonate, or of baryta or lime. It is not precipitated by acetate of lead, but is converted into oxalic acid by nitric acid. It impresses a permanent acrimony on the organ of tasting. If direct Sialagogues are to be confided in, the bark of the root of Mezereon is a local stimulant of this description of great power. This bark has a smooth olive-coloured epidermis, which covers a thin, green, cellular web, and a yellowish-white, tough, fibrous liber: when chewed, it tastes at first slightly sweetish, and then becomes hot and corrosive to the mouth. It contains, according to Gmelin, wax, resin, Daphnina, a red colouring matter, an uncrystallizable sugar, a brown colouring matter, malates, gum, and lignine. In a case of difficulty of swallowing from paralysis of three years' standing, Dr. Withering prescribed Mezereon root as a masticatory. In less than a month his patient recovered the powers of deglutition. A small portion of the bark should be kept constantly in the mouth; and the saliva should be as assiduously rejected as when tobacco is employed. Its injurious influence when taken into the stomach is well illustrated by the following fact. When the French army was in Corsica, the soldiers often dried their meat by smoking it with wood fires: some of them having used the Mezereon for this purpose, they were attacked with erosions of the mouth, stomach, and intestines, and died in great torture*.

Such are the few substances which are usually employed as direct Sialagogues—an order of remedies now rarely prescribed, but which, nevertheless, like Errhines, require to be known. There is one affection, not much understood and

* Sage sur le Moyen de Remedies aux Poisons Vegetaux.—Paris, 1811.

not described in the writings of medical authors, in which I am of opinion much benefit may be derived from the use of Sialagogues. I refer to a peculiar *dry* state of the fauces and soft palate, which is not an unfrequent sequel of inflammation of the mucous membrane of these parts. It appears to me to depend on a chronic subacute inflammation, which, from its habitual influence, interrupts the natural action of the mucous glands; and which is to be relieved by inducing a new action in the vessels of the part sufficient to overcome the diseased action. Sialagogues appear to be indicated in such cases; and, as far as my own experience can authorize an opinion, I think their use is likely to prove beneficial.

SECTION XII.

EXPECTORANTS.—MEDICAMENTA EXPECTORANTIA.

Syn.—Pectorales.

It is not easy to frame a satisfactory and comprehensive definition of this order of medicines: they are said to be medicines which promote the excretion of mucus and fluids from the lungs and trachea. Were the correctness of this definition fully determined, considering the great importance of the lungs to the well-being of the animal œconomy, there is no class of medicines that would so much merit our attention. But if any theory which can be given, not only of the mode in which Expectorants operate, but of their existence *at all* as promoters of the excretion of the mucus from the lungs, *be doubtful*, we must receive *every thing* that can be said regarding them with some degree of distrust.

The mucous membrane lining the air tubes of the lungs is *supposed* to be the *only* part upon which Expectorants, *if they have any influence*, can act; but in whatever manner the mucus, *either morbidly secreted or augmented in quantity*, is removed, it is essential to know the manner in which either its acrimony or its over abundance *can prove injurious* to the functions of life, before we can fully understand the necessity for removing it, or form any opinion of the manner in which it is excreted.

The whole system of pulmonary tubes is lined by a vascular and highly sensible membrane, an extension of the lining membrane of the fauces, and is denominated the mucous membrane, from the nature of the secretion with which it is constantly moistened. Each lung, therefore, is a tissue of air cells, into which the branches of the windpipe lead, and upon which the capillaries or ultimate divisions of the pulmonary arteries terminate. These air cells, it has been ascertained, are smaller in infants than in adults; in middle-aged adults, smaller than in older persons: the average in a middle-aged man may be estimated to be about $\frac{1}{90}$ of an inch in diameter. The form of the cell is nearly a hollow sphere; it does not communicate with any other cell, except by means of the *minute twigs* of the bronchial tubes, which terminate in them. Besides the mucous membrane which I have already mentioned, as lining generally the air tubes and the bronchial cells, each distinct cell is supplied, exteriorly to the mucous membrane, with a coat of *white*, *elastic* fibres; and over this a muscular coat. These cells are supplied with two sets of arteries; the one intended for the nourishment of the lungs, proceeding from the descending aorta, and named the bronchial arteries; the other designed to expose the blood to the action of the air in these cells, and forming the ultimate branches of the pulmonary artery, the trunk of which commences in the right ventricle. The intention of the ramifications of the pulmonic arteries upon the bronchial cells, is to expose the blood to the action of the air admitted into these cells, in order to change it from the state of venous into arterial blood. To effect this, the air must be received into the lungs; but it is no sooner admitted into the bronchial cells, than it is completely changed in its chemical character, and would prove hurtful and fatal to animal life were it retained there; it is, consequently, as rapidly expelled as it was received: and this alternate reception and expulsion of the air *into* and *from* the lungs constitute inspiration and expiration, or, conjointly, the function of respiration.

When the air is admitted into the lungs, the thorax is enlarged *laterally* and *inferiorly*, the ribs are elevated, the

diaphragm descends, and the recti muscles of the abdomen, with the oblique and the transverse muscles, are forcibly extended by the pressure downwards of the abdominal viscera. During this process the air rushes into the lungs, owing to the greater gravity of the external air than that contained in the lungs, in addition to the diminished resistance afforded by the enlargement of the cavity of the thorax, and distends the whole system of bronchial cells. Such is the mechanism of inspiration. Now, what follows ?—In a few seconds the mastoideus, the trapezeus, the serratus, the diaphragm, and intercostal muscles, cease to act, and the abdominal muscles recover their ordinary state of contraction ; whilst, at the same time, the substance of the lungs, contracting by its natural elasticity, resumes its former dimensions, and expels the additional volume of air which had just been admitted. But, in *addition* to these changes of condition in the respiratory muscles and in the lungs, generally speaking, the *muscular* and *elastic* fibres which surround the bronchial cells *now contract* and aid in the more effectual emptying of the lungs. This, however, is *never* completely effected ; as the retention of a certain portion of air is necessary to maintain some degree of distention of the air cells after expiration. When the contraction is so great as almost wholly to expel the last portion of air from the air cells—a circumstance which occurs in the spasmodic cough of hooping cough—as soon as the spasmodic contraction yields, the external air *rushes* into the lungs with a wheezing noise, resembling that which occurs when the air is admitted into the exhausted receiver of an air pump : but *no such sound* is heard in natural and healthy respiration. It is therefore obvious that this elasticity of the lungs is a very important agent in expiration; and, so little are the muscles of the abdomen concerned in this part of the respiratory process, that children who have been born without them, have lived for some time and breathed naturally ; yet it would be an error to assert that respiration is not the operation of the conjoint action of the mastoideus, trapezeus, serratus, and intercostal muscles, the diaphragm, the abdominal muscles, and the muscular contraction of the air cells of the lungs themselves, by which, as I have already stated, the last

portions of the air are expelled. Such, then, is the mechanism of the respiratory function.

The nerves engaged in effecting respiration arise from a distinct column or fasciculus of the spinal marrow, lateral as regards the anterior and posterior columns: and it is from the par vagum, one of the nerves receiving its origin from this fasciculus, that the nerves of the bronchial cells are derived. The excitement of these nerves, therefore, causes the function of respiration; that is, an alternate inspiration and expiration of the atmospherical air. That this function or breathing is absolutely necessary for the maintenance of animal life, every day's experience proclaims; and it is equally certain that the air expired differs from that inspired, not in the volume of the air only, but in its chemical constituents; and thence the function of respiration includes not only the renewing of the air in the lungs, but the changes which it undergoes there, and also those effected in the blood.

Without entering into the examination of this chemical change, it is sufficient for our purpose to know that the air must be admitted into the air cells for the preservation of life; and, therefore, that whatever obstructs its passage to these, is an obstacle which must be removed. When this is accumulated, or when the mucus is inspissated, or viscid and adhering to the sides of the bronchial tubes, or when the secretion is rendered acrid by inflammatory action being excited in the mucous membrane of these tubes, so as to impede in any manner the function of respiration, then Expectorants become useful, inasmuch as they can contribute to the removal of these morbid causes of *impeded*, or *interrupted*, or *irregular* respiration. A question naturally arises—how can they effect this removal? Do the substances taken as Expectorants proceed to the lungs, and there act?

Before answering these questions, it is proper to state, that many substances, when introduced into the system through the stomach, escape by the lungs. This is the case with various *gases*, *ether*, *alcohol*, *phosphorus*, and *camphor*, which, soon after they are taken into the stomach, are perceived in the breath; and this is the case with oil of turpentine, also, which, if injected in small quantity into the crural vein, as in

the experiment of Dr. Breschet and Dr. Edwards, is strongly exhaled from the lungs, although no odour of it is perceived on exposing the peritoneum ; and, what is very singular, if a cupping glass be applied over any denuded part, the odour is not perceived in the lungs. But while we are convinced that the lungs act as an emunctory, and afford exit to many things which have entered the circulation, yet, supposing that every medicinal article exhibited with the view of producing expectoration enter the circulation, and be thrown off by the medium of the mucous membrane of the lungs, it would not aid much in explaining the theory of Expectoration. We must therefore have recourse to some other method of accounting for the manner by which the lungs are freed from offending matters; that is, by which expectoration is effected.

In the table of Expectorants, those medicines which are supposed to operate as such are arranged into *two* divisions—*those* which effect the excretion of mucus or other fluids from the lungs by *topical* means ; and those which effect it by *general* means.

I. *Topical Expectorants* may operate in two ways. 1. They may act upon the nerves of the bronchial cells, and, exciting all the respiratory muscles into strong action, and rendering expiration more forcible, may *facilitate* the expulsion of matters from the air tubes of the lungs. 2. They may operate by mechanically compressing the thoracic viscera, so as to induce a sudden and forcible expiratory effort, so as to effect the expulsion of matters from the lungs.

1. *a.* Medicines which stimulate the respiratory muscles, effect the excretion by coughing.

The effect of coughing is a short and forcible expiratory effort, frequently repeated ; the inspirations in the intervals being trifling in comparison to the expirations. It is, in a great degree, a voluntary effort ; and the effect of the air, in traversing the trachea and its branches, in the forcible exit of each portion, as thrown out by the sudden contraction of the abdominal and other respiratory muscles, detaches any mucus, or whatever else is contained in the air tubes, and expels it. Any irritation immediately applied to the glottis, acting upon a branch of that series of nerves which are particularly

intended for the function of respiration, excites involuntary coughing; but the action excited may, in a great measure, be moderated, if it cannot be altogether checked and terminated at the will of the individual. Coughing is, therefore, an effort either of the will, or of the system, from the irritation of a certain set of nerves acting on the respiration muscles to relieve the trachea and bronchial system of some offending cause: it is therefore a salutary phenomenon. In those weakened by disease or other causes, the difficulty of exciting the action of coughing, with force sufficient to produce the effect intended, is so obvious as to strike the ordinary as well as the professional observer. The distress arising from this circumstance, the *uneasiness* excited by the irritating matter that coughing forcibly would readily remove, and the *sense of suffocation* experienced from an accumulation of mucus in the bronchial tubes obstructing the free passage of the air to the bronchial cells, are very considerable. In such states of the chest, the topical application of a stimulant to the bronchial nerves may so far rouse the exhausted excitability as to enable the muscles to undergo the necessary exertion; whilst, at the same time, the substances employed to excite this, may be of a nature to prove also beneficial, by imparting a renewed healthy action to the diseased mucous membrane. Under this head of the table, therefore, will be found several stimulants well adapted to fulfil this intention.

The whole of the substances arranged under this head stimulate so powerfully as to require the utmost caution in their administration; but, as the atmospherical air is the vehicle by which they are conveyed into the lungs, there is no difficulty in apportioning the degree of dilution to the quantity of stimulus required or admissible.

2. *a.* The second set of topical Expectorants are emetic substances. In the operation of vomiting, by the sudden and violent contraction of the abdominal muscles, in order to force the contents of the stomach upwards, an impulse is communicated to the whole bronchial system; and, by this means, the expiratory effort being rendered more forcible, the expulsion of the mucus lodged in the pulmonary tubes is effected. Whether this explanation be satisfactory, others must deter-

mine: the fact of the beneficial result of the action of emetics, in clearing away mucous accumulations from the lungs, is well known; and frequent recourse is had to them in the diseases of children, with uniform advantage.

It might be supposed that the best emetics for expectorant purposes would be those which operate by directly stimulating the nerves of the stomach, and which call the muscles, necessary in the mechanism of vomiting, into immediate action by sympathy with that organ: but experience has demonstrated that the antimonial preparations are, perhaps, better suited for this purpose than any other; not only because their action is more forcible, and therefore likely to aid in expelling the mucus of the air tubes, by the communication of the mechanical impulse which it produces, but also by the power which they possess of controlling inflammatory action. Expectoration procured by emetics was at one time in much vogue as a remedy in Phthisis *Pulmonalis*. The emetics for this purpose, however, were seldom selected upon any principles: at *one time* we find sulphates of zinc and of copper employed; in *another*, antimonials, chiefly in the form of the antimonial wine, or vinous solution of the tartrate of antimony and potassa, given to the extent of f℥vi in a solution of the extract of liquorice root. This antimonial was supposed to produce vomiting, accompanied with copious expectoration, whilst the force and frequency of the pulse were materially diminished. I have had opportunities of witnessing the effects of this mode of treating tubercular consumption; and certainly it must be acknowledged, that it has relieved many of the most urgent symptoms; yet, like every other remedy in that merciless malady, its frequent failure to produce the desired effect weakened my confidence, and I have long since discontinued prescribing it. Ipecacuanha and all other emetics act in a similar manner to those I have just mentioned, and promote expectoration.

If the lungs be loaded with mucus, and little or no febrile action be present, the *direct* emetics are to be preferred; because it is only the mechanical impulse which is then required.

Squill and sulphuret of potassa have also been employed to excite vomiting in aid of their expectorant property.

II. *General Expectorants.*—These operate either by entering the circulation or through sympathy with the stomach: the first directly stimulate the pulmonary exhalants; the second affect the excretories by the nausea which they induce.

a. There is sufficient evidence that some medicinal substances, when taken into the stomach or applied to the surface, are absorbed, and, entering the circulation, are exhaled by the lungs. No explanation can be given of the reason why these substances, passing through the circulating system, are thrown off by one emunctory rather than by another; but the fact is well ascertained. Now it is probable that these matters, in passing through the exhalant vessels, stimulate them directly to increased action, and thence to the performance, in an augmented degree, of their proper function; so that, by the production of a greater quantity of aqueous matter by the mucous follicles, their contents are poured out in a less viscid state. In admitting this explanation, to a certain extent, we must not lose sight of the fact, that the most easily excreted mucus from the trachea and bronchial tubes is not that which is in the most fluid state, but in that peculiar state which, independent altogether of simple consistence, is requisite to enable it to be readily excreted. In asthmatics, a thin or watery excretion is always more distressing and more difficult to expel, requiring a greater effort of coughing than one which is more consistent, and, as the term is, well concocted. The expired air passes partially through the thin fluid, giving it a frothy character; while that of a thicker description, which seldom adheres very firmly to the sides of the tube, is driven before the propelled air, and thus easily rejected from the trachea.

b. In explaining the operation of these general Expectorants, which affect the pulmonary excretions by the nausea which they induce, we must take into consideration the similarity between the function of the skin and that of the mucous membrane of the bronchial tubes. Both are exhalant organs; and both, in febrile and inflammatory states of the

habit, are liable to constriction, which impedes the exhalant function, and gives origin to a train of morbid phenomena connected with the deficiency of the natural lubricating mucous secretion. In this condition of the mucous membrane, nauseants taken into the stomach, either by the nausea which they induce, relax the constricted capillaries, or the same purpose may be effected by simply allaying irritation.

TABLE OF EXPECTORANTS.

A.—TOPICAL EXPECTORANTS:

1. *which stimulate the respiratory muscles;*
   a.—Benzoic Acid, obtained from
   Styrax *Benzoin* 20. 1. Styraceæ.
   b.—Acetic Acid,
   c.—Chlorine.

2. *which stimulate the pulmonary exhalants;*
   d.—Tobacco, the leaves of
   Nicotiana *Tabacum* 5. 1. Solaneæ.
   e.—Stramonium, the herb of
   Datura *stramonium.* 5. 1. Solaneæ.
   f.—Boiling Tar,
   g.—Burning Wool,
   h.—Ammonia,
   i.—Carbonate of Ammonia.

3. *which mechanically compress the thoracic viscera;*
   k.—Emetic Substances.

B.—EXPECTORANTS WHICH OPERATE GENERALLY:

1. *by stimulating the pulmonary exhalants through the circulation;*

* *Organic Products.*

a.—Emetina, contained in
Cepæelis *Ipecacuanha* 5. 1. Cinchonaceæ.
b.—Scillitina, contained in
Scilla *Maritima* 6. 1. Asphodeleæ.

c.—Gum Resins, secretions of		
Ferula *Assafœtida*	5. 2.	Umbelliferæ.
Dorema *Ammoniacum*	5. 2.	———
Galbanum *officinale*	5. 2.	———
Sagapanum.		
Myrrh.		
d.—Balsams, secretions of		
Myroxylon *Peruiferum*	10. 1.	Leguminosæ.
Styrax *officinale*	10. 1.	Styraceæ.
Styrax Benzoin	20. 1.	———
e.—Oleo-resins, secretions of		
Amyris *Gileadensis*	8. 1.	Amyrideæ.
Copaifera *officinalis*	10. 1.	Leguminosæ.
f.—Bitter Extractive, contained in		
Marrubium *vulgare*	14. 1.	Labiatæ.
Tussilago *farfara*	19. 2.	Compositæ.
Cetraria *Islandica*	24. 3.	Lichenes.

** *Inorganic Substances.*

g.—Ammonia.

h.—Carbonate of Ammonia.

2.—*by exciting nausea.*

* *Organic Products.*

a.—Emetina, contained in

Cepæelis *Ipecacuanha.*	5. 1.	Cinchonaceæ.

** *Inorganic Substances.*

b.—Antimonials.

c.—Potassæ Sulphuretum.

A. TOPICAL EXPECTORANTS.

1. *Substances which operate as Expectorants by stimulating the Respiratory Muscles.*

a. Benzoic Acid. *Acidum Benzoicum.* L. E. D.—This acid is procured by the mere application of heat to Ben-

zoin, a concrete balsam, the produce of the Styrax *Benzoin*, a tree growing in the island of Sumatra, belonging to the natural order Styraceæ*. The Benzoin is procured by incisions in the tree; the exuded juice concretes in the air, and changing from the white, which it possesses at first, it becomes a *variously coloured* mass. The odour of Benzoin is agreeable; its taste is at first sweet and aromatic, but it leaves a sensation of acrimony in the throat; it is brittle; melts when heated; and, when charred, exhales copious white fumes, which, when condensed, are found to be a crystallized acid, the *Benzoic*.

Before explaining the nature of this acid and its stimulant properties as an Expectorant, it is necessary to state that it is a constituent of all balsams. According to the analysis of Bucholz, Benzoin consists of resin 20.50, + Benzoic acid 3.7, + a substance analogous to balsam of Peru 0.25, + an aromatic principle soluble in alcohol 0.8, + impurities 0.30, in 25 parts. When Benzoin is thrown upon a hot iron, or exposed to heat in a crucible, it first melts and then the Benzoic Acid is exhaled in conjunction with an aromatic oil, to which it owes its odour.

Benzoic Acid, by whatever means procured, is a white, crystallized acid, in oblong, soft prisms, with a glossy lustre: inodorous when pure; but generally having a slight, peculiar odour, owing to a little volatile oil adhering to them; and a sweet, pungent, somewhat bitter taste. Its specific gravity is less than water, being 0.657. It reddens litmus paper. It is sparingly soluble in cold water, and requires even $24\frac{1}{2}$ parts of boiling water. Alcohol dissolves it readily, and, when left to evaporate spontaneously, prismatic crystals of the acid are formed: boiling alcohol takes up its own weight of the acid. It is composed, according to the analysis of Berzelius, of

Hydrogen...	5.27	6 prop.		= 6
Carbon......	74.41	15 prop.	(6×15)	= 90
Oxygen	20.02	3 prop.	(8×3)	= 24
	100.00		Equivalent	120

From this analysis, its affinity to the resins is very obvious.

* Woodville's Medical Botany, third edition, p. 294, pl. 102. London Dispensatory, art. Styrax.

In a healthy individual, the fumes of Benzoin excite coughing; but it is questionable whether they are admitted into the trachea, unless very largely diluted with atmospherical air; and it is only in this state that it can be employed in any affection of the pulmonary system. I have had no experience of its effects; but it is said to have proved beneficial even in phthisis after the existence of tubercles had been clearly ascertained. In this disease it has been inhaled in conjunction with aqueous vapour; the Benzoin, broken into small morsels, are put into a jar and boiling water poured over them; a little of the acid, but more of the volatile oil, is elevated with the aqueous vapour, and thus taken into the lungs. Inhaled through the medium of the air in spasmodic asthma, I have seen it shorten the paroxysm and promote expectoration. We can account for its beneficial influence in asthma more readily than in phthisis. I have long been disposed to ascribe the difficulty of breathing, and the frothy mucus accumulated in asthma, to some morbid state approaching to paralysis of the nerves of the par vagum; and thence, any stimulant likely to rouse these, if there exist a state of deficient energy, will probably relieve the disease. According to Mr. Brodie's experiments, when the par vagum is divided in a dog, the respiration is diminished in frequency, less carbonic acid is evolved, the blood assumes a darker hue than usual, and much frothy mucus is found in the cells after the death of the dog. These are the symptoms of chronic asthma; and it is in this form of asthma that diminished energy of these nerves may exist. I would, nevertheless, be more sceptical regarding its use in phthisis, were I not acquainted with the beneficial effects of some other substances, which can only operate on the same principles.

This acid is occasionally administered internally, for the purposes of rousing the muscular energy and promoting expectoration in weakened habits; but it is much inferior to carbonate of ammonia for this purpose. It is sometimes prescribed in the same manner in pulmonary consumption; but upon what principle I am at a loss to conceive. Its topical or external use in asthma is more easily explained; and probably, from the nature of its stimulant properties, it may

prove beneficial in Phthisis: but still, even in this respect, it is inferior to many other topical Expectorants.

b. ACETIC ACID. *Acidum Aceticum.* L. E. D.—This volatile acid operates by stimulating the bronchial cells, when it is inhaled into the lungs. This is the oldest of those topical remedies which are supposed to excite the action of the respiratory muscles, in clearing the pulmonary tubes of offending mucus. It is more manageable in its application than the benzoic acid, and it can be more directly applied. It is usually extricated from hot diluted vinegar by means of the inhaler; the warm air holds the acetic acid in solution whilst it is also combined with aqueous vapour, which aids in relieving spasm. The acid thus evolved communicates the desired stimulus to the bronchial nerves. Distilled vinegar should be employed, instead of the common vinegar which contains sulphurous acid. The vapour of Acetic Acid is employed with seeming advantage in asthma, dyspepsia, and other spasmodic affections of the chest.

c. CHLORINE. This gas is of very late introduction as an Expectorant and Excitant of the diseased mucous membrane of the lungs.

Chlorine gas is rapidly absorbed by water; and in this form it may be preserved for extricating the gas for expectorant purposes; but it must be kept in a blackened bottle, as the water is slowly decomposed, and chloric and muriatic acids are formed. Its goodness is known by mixing the solution with a little tincture of litmus: if the solution be good, the colour of the litmus will be totally destroyed; if it contain chloric or muriatic acid, the litmus will be reddened.

Chlorine, if attempted to be breathed in its undiluted state, does not enter the lungs, but produces a powerful spasm of the glottis; and, if not immediately relieved, the person dies of suffocation. When diluted with a moderate portion of air, it excites violent coughing, irritation in the bronchial cells, great dyspnœa, and a painful, anxious sensation in the chest, which continues for several days. Yet, when largely diluted, this gas is the best topical expectorant and the most salutary excitant to the mucous membrane of the lungs that has yet been inhaled. I have witnessed its beneficial effects in spas-

modic cough and in asthma; and I have seen much benefit result from its cautious employment even in phthisis pulmonalis.

This gas, in its highly diluted state, was first proposed to be employed as a pneumatic remedy and an Expectorant by Dr. Favart, of Marseilles, in 1804. His explanation of its action is, "that by irritating in a peculiar manner the mucous membrane, it draws towards that membrane the matter gorging the pulmonary parenchyma; and, thus rendering it susceptible of evacuation, it relieves the lungs in severe catarrh." It is unnecessary to comment on the improbability of this hypothesis. Soon after this period, I had an accidental opportunity of witnessing its beneficial influence in a severe case of epidemic catarrh, in which it was extricated as a fumigation to check infection; but it was not employed either on the Continent, or in this country, by more than one or two physicians, until lately, when a report of Dr. Cottereau, to the Faculty of Medicine of Paris, again brought it before the profession.

Several trading chemists, and in particular a M. Gannal, had remarked that phthisical persons, who engage themselves to work in the manufactories of bleaching liquor, and other processes, in which Chlorine is extricated, are gradually, but evidently improved in health; and, to confirm his observations, he constructed an instrument for inhaling it, and actually administered it as a remedy in phthisis. The success of the experiment surprised M. Gannal; but not being a medical man, he mentioned his views to Dr. Cottereau, who pursued the same plans as M. Gannal, and with a degree of success sufficient to merit the attention of the profession. As far as my own experience enables me to offer an opinion, Chlorine will form a most valuable auxiliary in the treatment of chronic catarrh, humoral asthma, and even phthisis. In the two former diseases, I have relieved several individuals by its means; and, in all the cases of phthisis in which I have employed it, the benefit has been sufficient to encourage the most sanguine expectations of success; but none of the cases have been cured.

For the purposes of inhaling, Chlorine should be extri-

cated from the saturated aqueous solution of the gas, by putting fʒi or fʒii of it into a tubulated bottle*, containing about f℥ii of hot water, and placed either in a basin of hot water or over a small lamp, in order to extricate the Chlorine from its aqueous solvent. The patient should inhale this quantity at one time, and the dose should be repeated once, at least, every six hours, so as to maintain the effect produced on the mucous membrane.

When thus cautiously inhaled, the evident effect of Chlorine is, at first, a slight sense of constriction in the trachea and some increase of cough: in a few instances, a degree of vertigo has been experienced and a tightness across the chest; but these feelings rapidly subside, expectoration is produced almost without any effort, and the patient feels generally more comfortable than before inhaling the gas. In those cases of asthma in which I have seen the Chlorine used, the relief is peculiarly striking; and even in phthisis, the symptoms of hectic have much abated during its employment; so that in cases in which a fatal termination of the disease has occurred, the Chlorine may be said to have "scattered flowers on the borders of the grave." Its operations can only be explained on its stimulant power, producing a new action in the morbid organ; which, if it could be maintained sufficiently long, might assuredly overcome the diseased action; and by the assistance of other means calculated to support the tone of the habit, without exciting fever, the disease might be cured. In cases where large vomicæ exist, it is in vain to expect a cure from any means; but when we consider the powerful influence of Chlorine in checking putrefaction and in promoting the cure of external ulceration, it is not, in my opinion, a vain speculation to expect advantage in ulcerated lungs from this mode of employing Chlorine.

Like every other powerful gaseous excitant, Chlorine, when inhaled without being sufficiently diluted, produces a severe sense of strangulation, a violent irritating cough; and individuals have fallen down in a state of complete syncope who have suddenly taken a large draught of it. These effects, however, are only temporary; and few instances have occurred in

* See vol. i, p. 723.

which inflammation of the lungs and air tubes have supervened. Indeed to no other gas does the system so soon accommodate itself; the workmen in chemical manufactories breathe it daily with impunity*. The best method of overcoming its deleterious effects is to inhale the vapour of ammonia diluted with water or to inhale ether; or, if neither of these substances be at hand, to hold the head over a basin of boiling water, so as to breathe the warm vapour.

d. Ammonia, Carbonate of Ammonia. L. E. D.—These substances operate in the same manner as the three former articles. Both act as violent irritants on the mouth, windpipe, and indeed on the substance of the lungs; nevertheless it has been proposed to inhale Ammonia, largely diluted, in cases of humoral asthma and pneumonia, in which the lungs are choked up with frothy mucus which cannot be expectorated. I have seen the internal administration of Ammonia highly beneficial in such cases; but my experience does not permit me to offer an opinion on its utility when in a gaseous state. Cases are related by Nysten and Orfila of fatal effects having followed its imprudent inhalation by the nostrils. In one of M. Nysten's cases, the patient, a medical man, died on the third day, after having suffered from symptoms resembling those of severe bronchitis, with difficult breathing, copious expectoration, and a serous discharge from the nostrils; and, in a case detailed in the 14th vol. of the Edinburgh Medical Journal, dissolution occurred in forty-eight hours. These cases render much caution requisite in using Ammonia as a topical expectorant.

2.—*by mechanically compressing the Thoracic Viscera.*

Emetics.—In the operation of Emetics, by the sudden and violent contraction of the abdominal muscles, in order to force the contents of the stomach upwards, an impulse is communicated to the whole bronchial system, and by this means, the expiratory effect being more forcible, the expulsion of the

* Mr. Tenant, one of the greatest manufacturers of bleaching liquor, has informed me that men affected with chronic cough, who apply to him for work, invariably lose their coughs when they are cautiously brought into the gas house.

mucus in the pulmonary tubes is effected. The beneficial influence of Emetics in clearing away mucous accumulations from the lungs is indeed well known; and they are advantageously prescribed for this purpose in some of the pulmonary diseases of children. It might be supposed that the Emetics most likely to promote expectoration would be those which operate directly on the stomach, and which call the muscles necessary for the action of vomiting into immediate operation: but in many cases the antimonial preparations are better suited for this purpose than any other emetics: for, besides aiding the expulsion of mucus from the bronchial tubes, they possess the power also of controlling inflammatory action. The employment of emetics for promoting expectoration was formerly in much vogue as a remedy in phthisis; but the selection of emetics for this purpose was seldom regulated by any principles: at one time we find sulphate of zinc and sulphate of copper the favourites; at another, antimonials, ipecacuanha, and other nauseating substances. If the lungs be loaded with mucus, and little or no febrile action be present, the direct Emetics—such, for example, as the sulphates of zinc and of copper—are to be preferred; for, in this case, the mechanical impulse only is required: but if, in promoting expectoration, we are desirous of producing and maintaining nausea afterwards, then the emetics to be selected are the antimonial preparations, squill, sulphuret of potassa, and similar substances. In general, however, these nauseating Expectorants are employed rather to affect the pulmonary exhalants through the medium of the circulation, than to evacuate the pulmonary tubes by the mechanical action communicated to them in the effort of vomiting: thence their influence will come more regularly before our notice in the second division of this class of remedies.

3.—*by stimulating the Pulmonary Exhalants.*

The substances in this section of Expectorants, instead of exciting the respiratory muscles, operate solely on the pulmonary exhalants; and as sedatives they relieve the constriction on these vessels, and thereby facilitate expectoration. In those unaccustomed to their use, they undoubtedly excite

coughing; but in this case the spasmodic action is produced by their first impression on the glottis; for when they arrive at the bronchial cells, no coughing is produced.

a. TOBACCO. *Nicotianæ Tabaci folia.* L. E. D.—Smoking Tobacco has long been known to the unprofessional as the means of allaying violent paroxysms of asthma; but many years have not elapsed since it was prescribed for this purpose by the physician. Whether it is the *Nicotina* or the *volatile oil* which is the active agent in this case, is still doubtful.

Let us examine a little in detail the manner in which Tobacco operates in stimulating the pulmonary exhalants, when received into the lungs in the form of smoke. It has been already mentioned that Tobacco contains two active principles, *Nicotina* and *volatile oil*, both of which act powerfully on the animal œconomy, but in a distinct manner. The Nicotina is more volatile than the oil; and, smoking being a species of distillation, it comes over with the smoke, and is the principle which operates in this mode of using Tobacco. It first acts as a topical excitant to the mucous membrane of the pulmonary tubes, and afterwards upon the circulating system through the medium of the nerves. This is rendered more evident by the effect of the infusion or the syrup, which contain the Nicotina, when these are administered in that state of the chest in which there exists something like œdema of the organ, and in which the expectoration is difficult or wholly impeded. In such a state, the infusion or the syrup aids powerfully the expectoration. Nicotina in large doses paralyzes the heart, rendering it insensible to the stimulus of the blood, and the circulation ceases: on this account, we find that fatal effects have arisen from excessive smoking*; and to the same cause must we attribute the vertigo, sickness, and fainting, which, almost invariably, the first essay in smoking produces on those unaccustomed to it.

Much of the influence of smoking, either as an expectorant or as a sedative, depends on the kind of Tobacco which is employed. The coarse, acrid Tobacco employed by the lower

* Philosophical Transactions, 1811.

classes of the people in this country, which is the produce of Virginia, contains the largest proportion of Nicotina, and produces the most powerful expectorant effects; but, at the same time, to those unaccustomed to smoke, the most unpleasant results occur. The Turkish Tobacco is milder and weaker than the Virginian, and has a sweet or honey-like flavour; but, of all the varieties of this potent herb, the Tobacco most prized for smoking is that which is reared in Cuba and on the Rio Nigro. The Tobacco of Cumana is the most aromatic*. Upon the whole, the salutary influence of smoking Tobacco in promoting expectoration cannot be denied, whilst at the same time its narcotic power, when it is employed in excess, weakens the digestive function, obtunds the nervous sensibility, and depresses the whole vital energy.

2. STRAMONIUM. *Daturæ Stramonii Herba.* L. E. D. —The nature of this plant and its active principle, *Daturia*, have been already described. The custom of smoking the dried herb was introduced from Ceylon; and some years since it was a favourite and useful remedy in spasmodic asthma. It seems to act in two ways: in the first place, it is applied to the mucous membrane in a state of great irritability, and, by operating as a sedative and allaying this state, it permits the secretion of the mucous follicles to be effected more slowly and perfectly; so that the mucus, being formed in a more natural state, is easily separated and excreted: in the second place, by influencing generally the nervous system, the spasmodic symptoms attendant on the paroxysm of asthma are allayed, and respiration proceeds in a calm and

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* It is pleasing to trace the origin of popular customs: that of smoking is unknown; but all the Scythian nations employed certain herbs, which they threw into the fire, and the ascending smoke of which the company seated round the fire collected, causing them to dance and sing*. They had also a religious order who smoked herbs through wooden and earthen tubes†; and this mode of using Tobacco prevailed in America when Columbus discovered that continent. "The calumet, or pipe of peace," says Harris, "is a large Tobacco pipe, with a bulb of polished marble and a stem two feet and a half long, made of a strong reed, adorned with feathers and locks of women's hair. When it is used in treaties and embassies, the Indians fill the calumet with the best Tobacco, and, presenting it to them with whom they have concluded any great affair, smoke out of it after them." —Harris's Voy. fol. 1705, v. ii, p. 908.

* Herodotus, lib. i, § 36. † Strab. lib. vii, p. 196.

undisturbed manner. I am fully aware that the power of Stramonium, employed in this way, has been much overrated; but experience has sufficiently demonstrated its influence in mitigating the violence of the asthmatic paroxysms, although it may effect little in establishing the permanent relief of the disease. This use of Stramonium has been objected to by Dr. Bree, a high authority on this subject, from an idea that it gives a tendency to apoplexy; but my experience has afforded me no reason for according with such an opinion.

3. Vapour of boiling Tar.—Sir Alexander Crichton introduced the inhalation of the fumes of boiling Tar as a remedy in phthisis. If we examine the components of Tar which are most likely to be elevated in the process of boiling, there can be no doubt that the empyreumatic oil and the acetic acid, dissolved in aqueous vapour, are the active principles which stimulate the bronchial tubes and effect the benefit in this case. It produces, in general, some increase of cough on the first application of it; but by degrees this abates, and the nature of the expectorated matter is so much improved as to promise the most salutary results. Like many other new remedies, the vapour of Boiling Tar was overpraised; and, from too high expectations of its powers having been formed, it has fallen into neglect, the natural consequence of exaggerated encomiums. Dr. Chapman, an American professor of Materia Medica, brings forward, as evidence in favour of this method of applying Tar in consumption, the circumstance that "a residence in the cedar and pine swamps of North America, during the summer months, is well known sometimes to have been productive of advantage in pulmonary cases." But Dr. Chapman, in writing the sentence which I have just quoted, seems to have forgotten the established fact, that swampy situations and damp places, favourable to the production of agues, is favorable also in a striking degree to the improvement of pulmonary cases. In our expedition to Walcheren, so destructive to our soldiers, by the intermittents and remittents under which they suffered, many of them who were afflicted with incipient Phthisis pulmonalis lost their coughs, and in every respect were cured of their pulmonary complaints.

Another fumigation, which operates in some degree in the same manner as the vapour of Tar, was tried by myself in some cases of phthisis, two years ago. It is the fumes arising from *burning wool* which has not been dressed. The cases in which I tried it were those in which there existed open ulcers. In one of them a vomica had burst fortunately into the trachea, and the contents were coughed up. The daily excretion of pus amounted nearly to a fluid pint; and, as may be well imagined, greatly debilitated the patient. The smoke of burning wool excited great coughing when it was first inhaled; but this rapidly subsided; and, although I cannot aver that any good actually arose from the inhalation of this smoke, yet, until a week before the death of this young gentleman, I never witnessed in this disease so little disturbance of the habit as he suffered. The use of this vapour was first recommended by Dr. Physick, a popular American physician, who found it extremely useful in stimulating and healing external sores, and thence naturally inferred that it might be equally beneficial if received into the lungs. He conceived that he had established the fact of its utility in consumption; but it has not yet accomplished one complete cure.

B. GENERAL EXPECTORANTS WHICH OPERATE THROUGH THE CIRCULATION, OR BY SYMPATHY WITH THE STOMACH.

1.—*stimulating the Pulmonary Exhalants.*

a. EMETINA.—In its pure state, this substance is white, pulverulent, unalterable in the air, sparingly soluble in cold water, more soluble in boiling water, very soluble in alcohol, but insoluble both in ether and in the oils. Pure Emetina is inodorous and only moderately bitter to the taste; but, in the ordinary state in which it is obtained, in dark brownish-red scales, deliquescent in the air; it is very bitter, although free from the nauseating flavour of ipecacuanha. The ultimate components of Emetina, according to the analysis of Pelletier and Dumas, are—Carbon 64.57, + oxygen 22.95, + hydrogen 7.77, + nitrogen 4.0.

Emetina is procured from the cortical part of the root of

CEPHAËLIS *Ipecacuanha*, a small plant found in woods and shady places in Brazil, in the provinces of Fernambucca, Bahia, Rio Janeiro, and Mariana, belonging to the natural order Cinchonaceæ*.

The roots of this plant are in diameter the size of a small quill, contorted, wrinkled, covered with a brownish-grey, thick bark, deeply fissured transversely, so as to resemble rings, or cylindrical beads strung upon a thread. In the entire state, Ipecacuanha is inodorous; but, when reduced to powder, it has a faint nauseabond odour; its taste is nauseous, bitter, and slightly acrid. Water at 212° takes up eight parts in twenty, alcohol four only, and proof spirit six and a half; the alcoholic is the most active of these solutions. The central part of the root is woody and inert. According to the analysis of Pelletier, 100 parts of brown ipecacuanha yield 16 of Emetina, + 2 of a fatty matter, very acrid but not emetic, + 6 of wax, + 10 of gum, + 42 of starch, + 42 of lignine, with traces of gallic acid †. To procure the Emetina, the powder of the root is first digested in twice its weight of ether, which separates the fatty matter; and the residue is afterwards digested, with the aid of heat, in four times its weight of highly rectified alcohol, until it cease to be coloured. The alcoholic solution reduced to dryness, is redissolved in water, this aqueous solution precipitated by acetate of lead, and the precipitate acted upon by sulphuretted hydrogen gas: this throws down the lead, while the Emetina is left in solution. On evaporating the solution, the Emetina is procured in brownish-red, diaphanous, inodorous scales, which are still necessary to undergo several solutions in ether and alcohol, and to be treated with magnesia more than once before it can be obtained pure. It possesses the same properties in its impure as in its pure state, differing only in strength.

Emetina is precipitated by gallic acid and by iodine, both of which form compounds with it devoid of emetic properties. All astringent vegetable infusions copiously precipitate the

* Woodville's Med. Bot. 3rd edition, vol. v, p. 14. London Dispensatory, art. Cephaëlis.

† Annales de Chimie, vol. iv, p. 181.

infusions, Wine and Tincture of Ipecacuanha, the precipitates being tannates of starch with gallates of Emetina. The infusions are also precipitated by solution of muriate of mercury and subacetate of lead: all these substances, therefore, are incompatible with preparations of Ipecacuanha.

I have had no experience of the influence of Emetina as an expectorant in its uncombined state; but from knowing the effect of small doses of Ipecacuanha, when no nausea is produced, I am willing to give credit to the French physiologist, that it exerts a peculiar influence on the pulmonary exhalants. Pure Emetina is rarely administered: in doses of one grain it produces vomiting; the impure preparation requires to be administered in doses of four grains to produce the same effect. Its actions on the pulmonary tissue is demonstrated by the post-mortem examination of dogs poisoned by large doses of it; and this, whether it be administered by the mouth or the anus, or injected into the jugular vein: in every instance the mucous membrane of the lungs was found inflamed. In old chronic catarrhs, the French physicians have successfully administered it, in doses of the eighth of a grain three or four times a day; and, in more recent catarrh, they found it equally beneficial in doses of a quarter to half a grain. In these cases it appears to operate, without exciting nausea, by simply promoting expectoration. Now, if we admit that it is determined to the lungs as its emunctory, after getting into the circulation, we can understand in what manner it produces its effects, as readily as we can comprehend the reason why old and chronic catarrhs are benefited by the inhalation of chlorine, tar vapour, and other substances that are directly applied to the mucous membrane of the bronchial cells. If we do not admit its direct influence on the pulmonary exhalants, I cannot conceive in what manner it operates, as there is no reason to doubt its beneficial effects. When the Ipecacuanha itself is given in small doses, it is beneficially combined with opium, in the form of Dover's powder. In doses of three or four grains of this powder, which contain about one third of a grain of Ipecacuanha and the same quantity of opium, given in f℥iss of almond emulsion, I have seen the most decided beneficial effects when

neither sweating nor nausea was produced. The French physicians conceive that Ipecacuanha in substance is less energetic in pulmonary affections, owing to the peculiar fatty principle which it contains interfering with the narcotic influence, as they conceive, of the Emetina. Setting aside their hypothesis, for it is an hypothesis, the evidence of the influence of Emetina, as an expectorant, is amply sufficient to recommend it to the notice of British practitioners. At all events, I have no hesitation in ascribing the influence of Ipecacuanha, in small doses, to its introduction into the circulation and its stimulant effect on the pulmonary exhalants. Ipecacuanha may be administered, for expectorant purposes, in the form of powder or in that of wine. The medium dose of the former is from gr. ss to gr. ii, that of the wine from m. xx to m. xl in any bland vehicle, containing neither tannin nor gallic acid.

b. SCILLITINA.

This substance is asserted to be the active principle of the Squill, a well-known expectorant. It is pulverulent, has somewhat of the character of a gum, is inodorous, but extremely bitter to the taste, and leaves a slight impression of sweetness upon the palate; is very soluble in water, and deliquescent when exposed to the air. Scillitina was regarded by Vogel, its discoverer, as a simple substance*; but M. Tilloy, of Dijon, has demonstrated that it is a compound of an uncrystallizable sugar, gum, and a bitter acrid principle†. It has not yet been employed as a curative agent in its separate state.

SQUILL, *Scillæ maritimæ bulbus*, L. E. D. is the bulb of a plant, found on the shores of the Mediterranean, and also on those of Normandy, Britany, Spain, Portugal, Sicily, Syria, and elsewhere, and belonging to the natural order Asphodeleæ‡. The bulb is sliced transversely, and dried at a moderate temperature. As it attracts moisture from the air, it should be

* Bulletin de Pharm. tome iv.

† Journ. de Pharm. tome xii, p 635.

‡ Woodville's Med. Bot. 3rd edit. p. 715, pl. 255. London Dispensatory, art. Scilla.

preserved in well-stopped bottles. In this state it contains about 0.70 parts soluble in water, and 0.30 of woody fibre. According to Vogel, the soluble portion consists of 35 parts of Scillitina, + 34 of tannin, + 6 of gum, with traces of citrate of lime and saccharine matter. If Scillitina be the active principle, it is probable that the powder of squill undergoes decomposition in transitu, and that the Scillitina operates as a stimulant to the mucous membrane of the bronchial tubes. This is a very plain statement; but it is more easily made than demonstrated; and much obscurity still involves the modus operandi of Squill. According to Vogel's analysis of Squill, it contains, besides the Scillitina, 34 per cent. of tannin, which, in conjunction with the bitter of the Scillitina itself, will aid the digestion of the mucilaginous constituent of the Squill; and in this manner the Scillitina may be carried into the circulation. Scillitina dissolves readily in alcohol, wine, and vinegar; and this partly accounts for the fact, which experience has amply demonstrated, that these vehicles are the best for the administration of Squill as an Expectorant.

As Squill is an excitant, it is scarcely necessary to say that its use is contraindicated in all inflammatory cases. As an Expectorant, it is usually combined with honey and vinegar, in the form of what is termed an oxymel; or with soap and ammoniacum, as in the Squill pill of the Pharmacopœias. It is chiefly useful in asthma and chronic catarrh. In large doses it is apt to prove emetic and purgative, or diuretic; so that the dose must be small, not exceeding one grain of the dried bulb, in order to secure its expectorant effect. Thirty drops of the tincture is equivalent to this quantity of the dried bulb.

When overdosed, it excites the most violent vomiting, purging, and convulsions; symptoms which induced Orfila to refer its operation to the nervous system; and his opinion is partly confirmed by the fact, that the lungs, on dissection, present no appearances of inflammatory action. The best antidotes are ammonia and other alkalies; on which account these substances ought not to be prescribed in combination with Squill.

In remarking that Squill contains a large proportion of tannin, the propriety of combining ipecacuanha with it might be justly questioned; and were I not aware that *pure* tannin scarcely effects Emetina, I should not be able to reconcile such discrepancies.

c. GUM-RESINS.

The chemical nature of these substances has been already described, (vol. i, p. 615): it only remains to speak in detail of those which possess expectorant properties.

1. ASSAFŒTIDA.—The origin of this Gum-Resin has been already traced. Dr. Cullen first remarked that, when it is taken into the stomach, it stimulates not only that organ, but rouses also the action of the respiratory muscles, so as to aid the expulsion of whatever is accumulated in the pulmonary tubes. From the stimulant nature of Assafœtida, it is evident that it can only be employed when no inflammatory symptoms are present: experience has amply confirmed its efficacy in chronic catarrhs and in asthmatic affections of worn-out habits; but, in asthma, much of the benefit derived from it must be ascribed to its power of resolving spasm. Perhaps the best form of administering it, as an Expectorant, is that of pill in combination with ipecacuanha and extract of conium. The dose is from four to twelve grains of the Gum-Resin; but this dose should be repeated at short intervals.

2. DOREMÆ AMMONIACI, SUCCUS CONCRETUS. *Ammoniacum.* L. E. D.—Although Dioscorides has stated that the plant from which Ammoniacum is obtained is a native of Libya, and named *Agasyllis*, and Pliny has also noticed it, under the appellation of *Metopium*, yet both the plant itself and its native soil were equally unknown, until Lieutenant-Colonel Wright of the Royal Engineers, who lately travelled in Persia, discovered it in the vicinity of Jezd Khast, a town of Irak El Ajam, the antient Parthia, about forty-two miles south of Ispahan. The plant belongs to the natural order Umbelliferæ: a dried specimen, presented to the Linnean Society by Colonel Wright, has enabled Mr. Don to describe it; and, as it is a new genus, he has also named it*. Mr. Don informs

* Dorema, from the Greek δορημα, a gift or benefit.

us that the plant is not unlike Opopanax, "facie fere opopanacis;" and that the Ammouiacum exudes spontaneously from its surface. The genus Dorema is distinguished from Ferula and Opopanax, to both of which it is closely allied, by a large cup-shaped epigynous disk, completely sessile flowers, and solitary resiniferous canals*. The plant is called *Oshac* by the Persians: it is perennial, and grows without cultivation on the plains between Yerdekaust and Kumisha, in the province of Irak, exposed to an ardent sun. The proper juice "is so abundant that upon the slightest puncture being made it instantly oozes forth, even at the ends of the leaves. When the plant has attained perfection, innumerable beetles, armed with an anterior and posterior probe of half an inch in length, pierce it in all directions: it soon becomes dry, and the Ammoniacum is then picked off, and sent *via* Bushire to India, whence it is imported to Europe†."

Until these facts, collected by Mr. Don, and some remarks which appeared in the first volume of the Dictionnaire Universel de Matière Medicale, published in 1829, were laid before the public, there was much diversity of opinion respecting the Ammoniacum plant. Wildenow, who had raised an Heracleum from seeds picked from Ammoniacum, was induced to regard it as a species of that genus, and named it Heracleum *gummiferum:* Sprengel asserted that it was the Ferula *ferugala* of Defontaines; Olivier, that it was the Ferula *Persica;* whilst others contend that the plant was the Bubon *gummiferum* of Linnæus: in one point only all agreed, namely, that Ammoniacum is the product of an umbelliferous plant.

Ammoniacum is in irregular masses, yellow exteriorly, white within, and breaking with a vitreous fracture. It is also in tears and masses formed of agglutinated tears, which are also yellow on the surface and white within. The odour is faint, the taste bitter, nauseous, and pungent. It is sufficiently brittle to be powdered in a low temperature; but the powder again runs into a mass in warm weather. In a mo-

* Transactions of the Linnæan Society, 1832.

† Linnean Trans. l. c. quoted from the Trans. of the Med. Soc. of Calcutta, vol. i, p. 369.

derate heat it softens and loses five per cent. of its weight, probably water. It is partly soluble in water, forming a milky-looking emulsion; but by rest it deposits the resin, while about one-fifth of gummy matter remains in solution. The gummy solution reddens the tincture of litmus: it is precipitated by subacetate of lead and oxalate of ammonia. The resinous part of Ammoniacum resembles wax in many particulars. It unites with alkalies, forming soapy compounds, having a considerable bitterness: it is dissolved by sulphuric acid, and forms a solution which is decomposed by water. Nitric acid, aided by heat, decomposes it, and produces a yellow resiniform substance; and, on evaporating the fluid, a yellow resino-bitter residue is procured, which is partially soluble in hot water, and communicates to wool or to silk a beautiful permanent yellow colour, which resists the action both of chlorine and weak alkaline solutions. According to the analysis of Braconnot, one hundred parts of Ammoniacum contain 18.4 of gum, 70 of resin, 4.4 of a glutinous matter insoluble in water and alcohol, 6 of water, and 1.2 loss.

When Ammoniacum is taken into the stomach, its impression upon the nerves of that organ is transmitted to the respiratory nerves; whilst, at the same time, it is absorbed, and operates directly upon the bronchial tissue.

As an expectorant, Ammoniacum has been found useful in asthmatic affections, in peripneumonia notha, and in the chronic catarrh of old people. It has been employed in tubercular consumption; but it is too stimulant for the early stages, and the little probability of any thing so stimulant proving useful in the advanced stage of that disease, renders its employment then of little consequence. It is seldom given alone, but generally in conjunction with squill, antimonials, and sedatives. A curious form of prescribing it in conjunction with nitric acid is adopted in America. Two drachms of the gum-resin are triturated with f℥ii of nitric acid, diluted with f℥viii of water, until an emulsion be formed. A table spoonful of this solution is given in any bland vehicle, every two or three hours, in cases of old catarrhs, in which large accumulations of viscid mucus exist in the pulmonary tubes, with feeble and

difficult expectoration. I have had no experience of this form of prescribing Ammoniacum ; but the probability is in favour of its utility in cases of chronic cough attended with much weakness, to rouse the feeble powers of the respiratory muscles to enable the lungs to throw off the offending matter. I doubt, however, whether its powers are so striking as to supersede the use of the carbonate of Ammonia, so well adapted for such cases. It may be given in conjunction with Ammonia; and, in those irritable coughs which accompany hysterical affections and are attendant on dyspeptic and hypochondriachal states of the habit, no other expectorant produces so much benefit. The dose in these cases is from gr. viii to gr. x, three or four times a day.

3. GALBANUM. L. E. D.—When the first volume of this work went to press, the paper of Mr. David Don, " On the Plant which yields the Gum Ammoniacum," was not published. In that essay, Mr. Don asserts that the plant which affords Galbanum is not the Bubon *Galbanum* of Linnæus, but one which appears to constitute a new genus allied to *Siler*, but differing from it in the absence of dorsal resiniferous canals, and the commissure being furnished with only two. He proposes to call the plant Galbanum Officinale. He has seen the fruit only, which he has described*. The plant is probably a native of Persia, as the gum-resin is partly imported from Smyrna and partly from India. It is scarcely necessary to say that it belongs to the natural order Umbelliferæ.

As an Expectorant, Galbanum is supposed to possess properties closely resembling those of assafœtida; and it is given with the same view, that of aiding the expulsion of viscid or irritating matters from the bronchial tubes and cells, in chronic catarrh and humoral asthma. It may be given in doses of from gr. x to ʒss, in combination with ipecacuanha and any narcotic, two or three times a day.

4. SAGAPENUM. L. E. D.—This substance, the source of which is still uncertain, although it has been attributed to the Ferula *Persica*, is in masses of a reddish-brown colour, soft and semi-diaphanous. Its odour is disagreeable, somewhat

* Trans. of Linnæan Society, 1832.

resembling that of weak assafœtida: its taste is acrid and slightly bitter. According to the analysis of Pelletier, it consists of 27.13 parts of resin, + 15.97 of gum, + 0.80 of insoluble gum and other matters, + 0.20 of malate of lime, and 5.90 of volatile oil. It operates as a stimulating Expectorant; but it possesses no advantages over assafœtida, and is very inferior to ammoniacum. The dose of Sagapenum is from gr. vi to gr. xii.

5. MYRRH. L. E. D.—Under the head of tonics (vol. i, p. 682), some account is given of the conjectures which have been formed respecting the origin of this gum-resin, and of the little light which they have thrown upon the obscurity of the subject. Besides the resin and gum, which make up the greater part of Myrrh, it is found to contain a free acid, which is supposed to be carbonic acid, holding lime in solution, as the aqueous solution effervesces with sulphuric acid, and is precipitated by oxalate of potassa and ammonia.

The expectorant property of Myrrh, although it is very commonly employed in pulmonary diseases, is doubted by some physicians; and I have never observed it produce any beneficial effects when it is given alone. The use of Myrrh is chiefly indicated in chronic coughs and catarrhal affections of debilitated habits, when other and more decided Expectorants are conjoined with it; such, for example, as ipecacuanha or squill; but in these cases more is due to its tonic than to its expectorant properties. It is undoubtedly stimulant, and therefore ought never to be employed when decided inflammatory symptoms are present. In the advanced stages of pulmonary consumption, Myrrh is daily prescribed; and as it is in such cases that chlorine gas is most useful, I am disposed to recommend Myrrh as the best medicine for propping the habit during the topical use of chlorine.

Myrrh can only be regarded as an auxiliary in phthisis. In prescribing it, we must bear in recollection that its aqueous solution precipitates all the salts of lead and those of mercury; and consequently that they are incompatible in prescriptions with Myrrh. In phthisis, it may be advantageously combined with sulphate of zinc; and when there is much acidity of stomach, the gum-resin may be dissolved in liquor potassæ

or liquor ammoniæ, and administered in any bland aqueous solution, as, for instance, the almond emulsion. Its efficacy is well established in chronic catarrh and humoral asthma, in which its tonic property, in counteracting the exhaustion produced by profuse expectoration, is highly beneficial. The dose of Myrrh, as an auxiliary to Expectorants in such cases, is from four to eight grains, repeated every three or four hours.

d. BALSAMS.

The characters which distinguish a Balsam are its containing *resin*, *benzoic* acid, and *volatile oil*. The general properties and appearance of the Balsams are those of the resins; but when they are heated or digested in an acid, benzoic acid is procured, although it has been doubted whether this be the production of the process by which it is obtained, or whether it exists ready formed in the Balsam. But, as water dissolves the acid part of the Balsams, it is probable that the acid exists ready formed in them: alcohol and ether readily dissolve the entire Balsams. The strong acids dissolve them, and during the solution a portion of benzoic acid is separated. They exist both in the liquid and in the solid state.

The resin contained in the Balsams differs from common resin.* The purest common resin dissolves in sulphuric acid, affording a yellowish or reddish-brown solution, which precipitates whitish flocculi when dropped into water: the resin of the Balsams produces a beautiful red or deep crimson solution with sulphuric acid; and, when dropped into water, precipitate beautiful rose-red or crimson flocculi, which, when washed, do not contain any sulphuric acid; a fact demonstrated by nitrate of baryta, which, even when boiled over them, affords no sulphate of baryta. By heating, therefore, any Balsam to expel the benzoic acid, and then dissolving the residue in concentrated sulphuric acid, and precipitating it with water, the purity of the Balsam is readily ascertained by the colour of the precipitate.

The Balsams are of different consistence; some being

* This remark was first made by M. Dulong d'Astafort.—Journ. Pharm. 1826, p. 37.

solid, as Benzoin and Storax, others of a semifluid consistence, as that of Peru.

* *Solid Balsams.*

1. Balsam of Tolu. *Balsamum Tolutanum.* L. E. D. Balsam of Peru. *Balsamum Peruvianum.* L. E. D.—The former of these Balsams is stated to be the secretion of the Toluifera *Balsamum* of Linnæus, according to the British Pharmacopœias; but in truth the genus Toluifera has been proved by Humboldt to have been founded on false documents, and, consequently, not to exist. The pale-coloured Balsam, which derives its name from the town of Tolu, in South Ameria, is the produce of a species of Myroxylon, so nearly allied to that which yields the red Peruvian Balsam, Myroxylon *Peruiferum**, that it is, with much probability, asserted to be the same tree. This species of Myroxylon is a native of the warmer regions of South America, growing in the forests of Paxaten, Muna, Cuchero, and Puzuza. It belongs to the natural order Leguminosæ; it grows in the mountains of Tolu.

The character of the Balsam yielded by this tree is greatly modified by circumstances. When it is procured by incisions at the commencement of spring, "when the showers are frequent, short, and gentle," the Balsam is white; and, being collected into bottles, will remain liquid for many years: when it is deposited in calabashes, it condenses and hardens, and forms the dry white Balsam, which is named *Balsam of Tolu.* When the bark is boiled in water, the product is the dark liquid *Balsam of Peru.*

1. *Balsam of Tolu* is generally brought to this country in gourd shells, or calabashes; its odour is extremely fragrant, somewhat resembling that of lemons; its taste aromatic, and somewhat sweetish. In distillation it yields a small portion of volatile oil, and benzoic acid sublimes. According to Tromsdorff, it contains 88 parts of resin, 12 of benzoic acid, and 0.2 of volatile oil, in 100 parts. When digested in sulphuric or nitric acid, much benzoic acid sublimes; and when the nitric is employed, traces also of hydrocyanic acid

* Woodville's Med. Bot. 3rd edition, vol. v, p 48.

are evolved. It is wholly soluble in alcohol, ether, and the alkalies: when dissolved in a very small quantity of the solution of potassa, it loses its natural odour and acquires that of the clove pink. It forms the chief ingredient in two pharmaceutical preparations: a tincture, which is a simple solution of the Balsam in rectified spirit of wine, and which requires to be rubbed with mucilage before it can be rendered miscible with water; and a syrup, which is most readily prepared by adding to two pounds of simple syrup, immediately after it is prepared, and whilst yet hot, one fluid ounce of the tincture, and agitating until the whole is well mixed. It is also a component of the compound tincture of benzoin. In all of these preparations the Balsam of Tolu operates as a stimulant Expectorant; and, therefore, can only be administered in chronic catarrh and asthma, when it is necessary to rouse the energy of the lungs and respiratory organs, to promote the expectorant effort. In an opposite state of the chest, Balsam of Tolu is undoubtedly contraindicated, although the syrup, in the small quantity in which it is used to communicate taste and flavour, may be administered in any state of the system.

2. *Balsam of Peru* is a viscid, deep brown coloured fluid, somewhat of the consistence of fluid honey, having a fragrant odour, and a warm, pungent, aromatic, bitterish taste. When boiled in water for some time, the water becomes acidulated, and deposites, on cooling, crystals of benzoic acid. When distilled with water, it yields a small quantity of reddish limpid oil, in the proportion of $\frac{1}{16}$ of the Balsam employed; and benzoic acid sublimes in the neck of the retort. When distilled pure, very little oil is obtained until the heat is raised to 617, when a yellowish oil comes over abundantly, and benzoic acid sublimes; at a lower heat the products are an acid, water, and a dirty-looking benzoic acid. If the heat exceed 617, the Balsam is decomposed in every respect, a black, pitchy, empyreumatic oil, with plenty of carbonic acid and carburetted hydrogen gas, come over.

Sulphuric acid acts upon Balsam of Peru in the same manner as upon other Balsams. Nitric acid acts upon it with violence; but when the acid is diluted and distilled from

Balsam of Peru, the liquid in the receiver smells of bitter almonds, and, when treated with potassa, solution of proto-sulphate of iron, and muriatic acid, it shows evident traces of hydrocyanic acid. In this case, both the nitric and the benzoic acids are decomposed; the equivalent of nitrogen necessary to form the hydrocyanic acid is supplied by the nitric acid, whilst the carbon and hydrogen proceed from the benzoic.

According to the analysis of Stolze, it consists of balsam of Peru; 24 parts of brown, nearly insoluble resin; 207 of soluble resin; 690 of a volatile oil; 64 of benzoic acid; and 6 of extractive, in 1000 parts. It may be given to the extent of f℥i, triturated with yolk of egg to suspend it in water.

Balsam of Peru is a more stimulant Expectorant than that of Tolu; it is occasionally, but not often, employed in asthma, in old and debilitated habits: but it is chiefly used externally, to cleanse ulcers and promote their healthy granulation.

4. Storax. L. E. D.—This balsam, when pure, is a spontaneous exudation from the bark of the Styrax *officinale* *, a native of the South of Europe and the Levant. The tree belongs to the natural order Erinaceæ of Von Martius;—Styraceæ of De Candolle. Pure Storax is in concrete tears of a yellowish or reddish-yellow hue, having the consistence of wax, and an agreeable odour; it is now rare in the market.

The Red Storax, or, as it is called, Storax in mass, is of a clear reddish-brown colour, and consists of agglutinated masses, which are clammy when handled. It has an odour not unlike that of Balsam of Peru, and a warm aromatic taste. Both varieties are inflammable, and possess the general properties of the other balsams. Storax is a stimulant Expectorant; but it is a useless incumbrance of the Materia Medica; all the advantages which it possesses being more amply obtained from the Balsams of Peru and Tolu.

5. Benzoin. L. E. D.—Benzoic Acid has been already noticed in its separate state. Benzoin is the production of the Styrax *Benzoin*†, the balsam which yields Benzoic Acid in greatest quantity, and from which it is named. This tree grows in great abundance in the northern parts of Sumatra,

* Woodville's Med. Bot. third edit. p. 201, pl. 101.

† Ibid. p. 204. pl. 102. London Dispensatory, art. Styrax.

particularly in what is termed the *Batta* country. Very few trees are found in the south. On some parts of the coast it is cultivated, being a quick-growing tree. The seeds are sown in the paddee fields; and, when the trees acquire trunks of six or eight inches in diameter, incisions are made in the bark, from which the Benzoin exudes and is pared off with a knife. The first portion which exudes is the purest; it is white, soft, and fragrant, and is called *Head Benzoin;* the next in purity, which is mixed with parings of the wood, is called *Belly Benzoin;* and least pure, or *Foot Benzoin*, is very foul. The trees will bear these incisions ten or twelve years. The Head or best Benzoin is that which is sent to Europe; the rest being used in India and the Malay islands for burning to perfume the houses and to expel troublesome insects.

Before it can be packed in the chests in which it is brought home, the *tompangs* or *cakes* into which it is formed in Sumatra are broken into pieces, softened in the sun, and then pressed into the chests and casks.

Benzoin is procured in dry, pulverulent masses, of a pale reddish-brown colour, spotted with clear red, and intermixed with numerous small amygdaloid masses, or whitish tears, about the size and shape of an almond, presenting an even, translucent fracture. Benzoin has a sweetish balsamic taste, and an aromatic, agreeable odour when it is heated. Its sp. gr. is 1.068. According to the analysis of M. Bucholz, Benzoin contains resin, benzoic acid, a substance analogous to balsam of Peru, and a peculiar aromatic principle soluble in water and alcohol, besides ligneous matter and impurities. Stolze has also analysed the tears and their connecting mass separately, and found the following matters in 1000 parts of each.

	Tears.	Mass.
Yellow resin, soluble in pure ether...	798.25	88.00
Brown resin, insoluble in pure ether	2.50	697.25
Benzoic acid..........................	198.00	197.00
Extractive..............................	0.00	1.50
Impurities..............................	0.00	14.50
Moisture and loss.......................	1.25	1.75

Benzoin is wholly soluble in alcohol; the solution of potassa

also dissolves it rapidly, but crystals of benzoate of potassa are mixed with the solution. It is soluble in boiling nitrous acid; but, on cooling, a copious deposite of benzoic acid takes place. By digestion in nitric and sulphuric acid, it is converted into artificial tannin. The acid was formerly employed as a stimulant Expectorant; but neither acid nor balsam is now much used. The acid is one of the constituents of the T. Camphoræ composita of the London Pharmacopœia: a medicine much used in coughs, but too indiscriminately, without regard to diathesis.

As a stimulant Expectorant, Benzoin is advantageously employed in humoral asthma; but its effects do not differ from those of the other balsams.

When Benzoin is exposed to heat, the benzoic acid is exhaled in combination with a small quantity of aromatic oil, which gives it odour. On this account it is preferable to extract the acid by forming a benzoate with lime or potassa boiled with the Benzoin in a large quantity of water, and then to decompose the filtered solution by means of muriatic acid, which, uniting with the alkaline base, throws down the acid. This, after being dried, yields pure crystals of the acid by sublimation. The acid thus procured is inodorous; it has a sweetish aromatic taste; melts in a moderate heat, and is volatilized; but at a higher temperature it burns with a clear yellow flame. It is soluble in 24 parts of boiling water; but scarcely at all in cold water; alcohol dissolves it readily. According to Berzelius it is composed of 15 prop. of carbon $(6 \times 15) = 90$, $+$ 3 of oxygen $(6 \times 8) = 24$, $+$ 6 hydrogen $= 6 = 120$. It may be administered in doses of from gr. iv to gr. xii, combined with sugar or mucilage.

As a stimulant Expectorant it is useful in an atonic or debilitated state of the system, when the expectoration is difficult in peripneumonia and chronic catarrh.

All the balsams were formerly much employed as Expectorants in all pulmonic diseases, whether recent or chronic; whether pleurisy or asthma; pneumonia or phthisis pulmonalis. But there are, doubtless, unanswerable objections to the employment of balsamic medicines in the inflammatory stage of any pulmonary disease. Dr. Fothergill loudly denounced

the use of the balsams in such cases; but perhaps he carried his objections rather too far. Experience has demonstrated that, when the excitement is subdued, the balsams may be employed with advantage. The best form of giving them is to triturate them with sugar and yolk of egg. The mildest is the balsam of Tolu. An elegant mixture is formed by triturating from forty to fifty drops of the tincture with mucilage of gum, which renders it miscible in water. This emulsion is an excellent vehicle for the compound powder of ipecacuanha in obstinate coughs, when all inflammatory symptoms have subsided.

e. OLEO RESINS.

These are the proper juices of those plants which constitute the natural order Coniferæ, Amyrideæ, and some of the Leguminosæ: they are natural compounds of volatile oil and resin.

1. AMYRIS GILEADENSIS RESINA. *Balsam of Gilead or Mecca.* E.—This species of Amyris* is a native of Abyssinia; but, from being early transplanted into Judea, and being much cultivated in Gilead, it received the name of Balsam of Gilead. Burckhardt asserts that, at Szafra and Beder only, the Balesan or Mecca Balsam can be procured in a pure state. In the middle of summer small incisions are made in the bark, whence the Balsam flows, and it is taken off with the thumb nail. The purest is of a clear white colour; the next kind of a yellowish-white colour: the people of Szafra adulterate it with sesamum oil and tar. It has a strong terebinthinate odour; and a pungent taste: and, when set on fire, burns without leaving any ashes. The Arabs try its purity by dipping the finger into it, and then set set it on fire: if it do not burn the finger, they judge it to be pure; but if it burn the finger as soon as it is set on fire, they consider it adulterated.

The pure Balsam is bought up principally by Persians, who carry it to Djidda and Mecca; whence it arrives at Cairo, and undergoes adulteration. It is chiefly used in

* Woodville's Med. Bot. 3rd edit. p. 603, pl. 214. London Dispensatory, art. Amyris.

Upper Egypt, by the richer classes of the Hadjis, who put a drop into their first cup of coffee in the morning. It is rarely brought pure to Europe; and it is difficult to say what could induce the Edinburgh College of Physicians to retain it in the list of the Materia Medica.

2. COPAIBA. L. RESINA COPAIFERÆ OFFICINALIS. E. D. *Copaiva. Balsam of Copaiva.* — The tree which yields this specis of oleo-resin, the Copaifera *officinalis**, is a native of Brazil and Guiana, and belongs to the natural order Leguminosæ. The Balsam, as it is erroneously termed, is procured from incisions in the bark of the trunk; and it flows so abundantly that twelve pounds are often procured in three hours. This oleo-resin is of a bright-yellowish colour, of the consistence of thick oil, transparent and lighter than water; it has a strong disagreeable odour; an acrid, bitter taste; and a sp. gr. of 950. By distillation it yields a greenish-white, transparent, volatile oil, which has the odour of Copaiba, whilst a reddish-brown, solid, transparent, inodorous resin is left in the retort. According to the analysis of Stolze, 100 parts contain 45.79 of volatile oil, + 1.66 of a clammy resin, + 52 of brittle resin, and 0.75 of extractive. Copaiba is soluble in strong alcohol, ether, and the volatile and fixed oils: but insoluble in water, in which, however, it can be suspended by yolk of egg. It is often adulterated with castor oil, which may be detected by mixing three parts of the suspected Copaiba with one of sulphuric acid; if the Copaiba be pure, it forms a plastic, reddish mass. Copaiba owes its powers to the volatile oil which it contains: it has been prescribed successfully as an expectorant in chronic catarrh, with the view of inspissating rather than attenuating the mucus of the bronchial tubes. If, as is probable, it stimulate directly the mucous membrane, the effect produced may arise from a new action being induced upon the inflamed surface, in somewhat the same manner as occurs from its employment in gleet on the mucous membrane of the urethra: and it is only upon such a mode of action that we can account for any benefit which results from the administration

* Woodville's Med. Bot. 3rd edition, p. 609, pl. 216. London Dispensatory, art. Copaifera.

of Copaiba in the advanced stages of Phthisis. The average dose is from m. xxx to f℥i, combined with sugar and any bland fluid as an oleo-saccharum. It may also be given in the form of pills, by rubbing it up in the proportion of two parts of Copaiba with one part of the carbonate of magnesia, and leaving the mixture for some time at rest, until it become solid; if the Copaiba be pure, the mass remains diaphanous.

f. BITTER EXTRACTIVE.

The substances to be described under this head are little used in regular practice; but, nevertheless, they possess considerable expectorant powers.

1. MARRUBIUM VULGARE, *Common Horehound**, is an indigenous plant, found as a weed under every hedge. It belongs to the natural order Labiatæ. Besides extractive, Marrubium contains volatile oil, on which its strong and unpleasant odour depends: it is in the recent plant of Marrubium that this strong musk-like odour exists: it is soon lost when the plant is dried and kept. Marrubium has a bitter, slightly acrid taste: its medicinal properties evidently depend on bitter extractive and the volatile oil. Water takes up a considerable portion of these properties, and also an astringent principle, tannin, combined with gallic acid; thence persulphate of iron throws down a greenish-black precipitate when added to the watery infusion. The infusion contains a free acid, and precipitates nitrate of silver with bichloride of mercury and the salts of lead. It is also precipitated by oxalate of ammonia; and it is probable that the lime is in the form of a carbonate, as barytic salts throw down a precipitate, which is soluble in nitric acid.

The employment of this plant as an Expectorant, although it has been neglected in modern times, yet is of very ancient date. It was commonly employed in humoral asthma, when accompanied with much oppression, and with a tough, ropy, expectorated matter, difficult to be thrown off, or causing pain in its expectoration. Alexander Tralles recommends it

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* This species of Marrubium should not be confounded with Marrubium *nigrum*. Vide Woodville's Med. Bot. 3rd edition, p. 332, pl. 118.

greatly in phthisis pulmonalis; but, although I cannot accord with his eulogy of it in this cruel disease, yet it produces considerable benefit in that state of chest which has been named catarrhal phthisis, in which there is much cough with copious excretion of mucus, a diurnal fever, recurring twice a day, nocturnal sweats, and great prostration of strength. In this state, in which a tonic is clearly indicated, the Horehound may be prescribed with advantage.

Marrubium may be administered in the form of powder, mixed with syrup of white poppies, or in the form of an aqueous or a vinous infusion. On the Continent an extract is prepared; but it is much less useful than the other preparations, owing to the dissipation of the volatile oil. The infusion, made with ℥i of the dried plant to half a pint of boiling water, may be given in doses of f℥ii three times a day.

2. TUSSILAGO FARFARA. *Coltsfoot.* L. E. D.—This indigenous plant has been as much neglected as the marrubium, although it held a high rank as a pectoral among the ancients. The Tussilago *Farfara** belongs to the natural order Compositæ. The plant is found in great abundance on waste grounds of a chalky and argilaceous character, propagating itself by rhizomes, or underground, creeping stems†. The dried plant yields its medicinal properties to water: the decoction or infusion of the leaves strikes a black colour with sulphate of iron. It is copiously precipitated by subacetate of lead and oxalate of ammonia; but is little affected by any other reagent. Its active principle is unknown; but it is combined with a pure bitter, to which must be attributed its influence as a tonic, in combination with its expectorant power.

Decoction of Tussilago was a remedy for phthisis so early as the time of Dioscorides; but it has greatly lost ground in modern times, and is now seldom prescribed. But if it have not fulfilled the expectations that were formed of it, Tussilago, nevertheless, has properties which require the attention of the physician. As a tonic, it may be em-

* Woodville's Med. Bot. 3rd edition, p. 45, pl. 68. London Dispensatory, art. Tussilago.

† It is the plant which first shows itself when earth is thrown up from a great depth, as in digging wells, &c.

ployed in the latter stages of phthisis and in chronic catarrh; and I can bear ample testimony to its expectorant powers. In making the decoction, care must be taken to strain it carefully, as the hairs of the pappus of the flowers may be taken into the gullet, and produce much injurious irritation there. The decoction is made with two ounces of the dried plant to a pint of water, and may be administered in doses of from f℥iss to f℥ii three times a day.

3. Cetraria Islandica. *Lichen Islandicus. Iceland Liverwort.* — This plant belongs to the natural order Lichenes*. This species of lichen grows in great abundance in the North of Europe and Iceland: on almost every mountain in the north: and even in England, on the high grounds near Cambridge; and at Stiesserstone in Shropshire.

This lichen is inodorous; and, when chewed, tastes bitter and mucilaginous. It has been analysed by several chemists. According to Berzelius, 100 parts contain 3.6 bitter principle, + 3 acidulous tartrate of potassa and lime, + 1.9 extractractive, + 7 green wax, + 44.6 of fecula, + traces of gallic acid, and 36.6 of lignine. It is the bitter principle which bestows upon it its medicinal properties, and which, if it possess any influence as an Expectorant, must enter the circulation and stimulate the pulmonary exhalants. I have doubts if it possess any Expectorant influence; although this lichen has been vaunted as a *Pectoral* for more than 200 years. Scopoli, Dr. Herz, Schoneider, a Danish physician, Stoll, Tromsdorff, and a long list of physicians of Germany, have published their testimony to its efficacy in phthisis: but still it must be regarded rather as a tonic of a light kind, in combination with a feculacious nutriment, than as an Expectorant. In scrofulous affections, connected with irritation of the lungs, it has displayed much efficacy; but in correcting this diathesis, we must refer the benefit to its tonic

* The lichens are found in all humid places, and sometimes on the faces of the hardest granite rocks, from which, if they had roots, no nutriment could be drawn. What appear as roots, therefore, in this class of plants, are mere claws, as it were, to fix them to the trees, decayed wood, stones, rocks, and surfaces of whatever kind they are attached to: consequently they are not parasitic plants, but derive their nutriment by superficial absorption.

powers. A better idea of its value in phthisis cannot be given than in the words of Sir Alexander Chrichton. "In phthisis," says he, "its good effects consist in improving the matter to be expectorated; in diminishing the frequency of the cough, and rendering it more easy: in calming the irritability of the patient, and in preventing, or much moderating, hectic fever." In prescribing it, the bitter should not be ordered to be wholly removed, but only as much of it as can be taken up by cold water, in which the Cetraria should be steeped for twelve hours; after which the water should be decanted off, and the lichen squeezed between the folds of a coarse cloth: it should then be boiled up with fresh distilled water, until the whole assume a smooth gelatinous consistence. When this decoction is strained, it consists of starch, holding in solution a considerable portion of bitter extractive, and some traces of tannin. The best form of administering this decoction is to combine it with some of the mineral acids, and to sweeten it with syrup of white poppies. In this form it may be freely administered in cases in which the powers of life are sinking.

** *Inorganic Substances.*

Ammonia. Carbonate of Ammonia.—In mentioning the topical effects of Ammonia when taken into the lungs, in the form of vapour, I stated its utility as arising from the stimulus which it affords to the mucous membrane when in a highly relaxed state; and that, by calling into action the respiratory muscles, it enables the patient to expel from the lungs the superabundant mucus which, in such states of the chest, obstruct respiration and destroy life by suffocation. There is much risk, however, in the topical application of Ammonia in this manner; and therefore its internal administration is always to be preferred.

Ammonia possesses an immediate and powerfully stimulant influence on the animal œconomy, when it is taken into the stomach; its influence is exerted upon the nervous system, without quickening or increasing in the same degree the action of the heart and arterial system: it is, therefore, admirably adapted for this purpose. In the latter stage of inflamma-

tion of the lungs, when the expectoration suddenly stops, and suffocation is threatened, Carbonate of Ammonia is the best medicine to restore the power of expectorating, and maintaining the nervous energy necessary for that effort. The dose may be regulated according to circumstances:—it may be extended to ten, or even, occasionally, to sixteen grains, repeated every second hour until the effect is produced; when the dose must again be diminished, and the intervals extended. The chief inconvenience in the administration of such large doses of the medicine arises from the heat it excites in the fauces in the act of swallowing it; and, therefore, it is requisite to involve it in some mucilaginous substance; the best, perhaps, is simple mucilage of gum, diluted with the emulsion of almonds.

2. *Substances which operate as Expectorants by producing Nausea.*

* *Organic Products.*

a. EMETINA.—The nature of this substance has been already detailed. In attempting to explain the mode by which nauseating medicines produce expectoration, we must consider the sympathy which exists between the skin and the mucus membrane of the pulmonary tubes, and the similarity of the functions of both as exhalant organs. In febrile and inflammatory states of the system, both the skin and the bronchial membrane suffer constriction capable of impeding their exhalant function, and giving origin to a train of symptoms depending on a deficiency of the natural secretion. In this condition of the mucus membrane, nauseating substances operate by relaxing this constriction, and enable the secretion to proceed. Under such a state, it is probable that the mucus present in the air tubes is of a very acrid character; but as it remains adherent, it excites no effort for its expulsion. When, however, the constriction is relaxed, and the mucus becomes diluted and moveable, it still remains sufficiently acrid to stimulate the glottis and larynx, and thus to call into sympathetic action the whole of the respiratory muscles requisite for the effort of coughing, to expel the now

loosened mucus. To effect this purpose the Emetina is well adapted, either in its pure state or in combination, as it is found in ipecacuanha. In its uncombined state, brown or coloured Emetina may be administered in doses of a quarter of a grain in combination with syrup of Tolu; but, for expectorant purposes, the ipecacuanha is preferable to Emetina, both on account of the manner in which the active principle is sheathed in the powder of the root, and also because the Emetina has been found more likely to excite, in some individuals, inflammatory action in the stomach than ipecacuanha. This active principle appears to be separated, by the digestive process, from the other components of ipecacuanha, and taken into the habit: it passes to the lungs and produces a direct impression upon the pulmonary tissue. The dose of the ipecacuanha, to produce expectorant effects, is from a grain to two grains; but, in determining the dose, much depends on the nature of the vehicle in which it is administered. It cannot be administered in combination with any astringent infusion, as both tannin and gallic acid form with it insoluble compounds, which exert no influence whatsoever on the living system.

** *Inorganic Substances.*

b. ANTIMONIALS.—The most useful of these, for expectorant purposes, are the *Tartrate of Antimony and Potassa*, and the precipitated *Sulphuret of Antimony*. The nausea which both of these medicines excite relaxing the spasm of the capillaries of the mucous membrane, and permitting the exhalation to proceed, easily explains the dilution of the viscid mucus, and the production of that state in which it is most readily expectorated. Now, although this explanation of the action of the nauseating antimonials is satisfactory to a certain extent, as far as regards the pulmonary exhalants, yet, it is evident that the result would be much facilitated by administering, at the same time, the carbonate of ammonia, when the habit admits of it; by which means both the indications can be at once fulfilled—the viscid mucus is diluted, and the means of expelling it by coughing greatly aided.

The *Precipitated Sulphuret* was formerly much employed

in asthma and chronic catarrh; but the uncertainty of its operation greatly narrows the chances of its influence proving beneficial: the *Tartrate of Antimony and Potassa* is undoubtedly a more manageable and active preparation, and answers every purpose which can be expected from Antimonials. For producing its expectorating effect, it is given in minute doses—for instance, from $\frac{1}{10}$ to $\frac{1}{4}$ of a grain, repeated every second hour. It is best given in solution. To secure its operation, the body should be kept moderately warm; for cold on the surface checks expectoration. It is occasionally combined with squill and other vegetable Expectorants: but these combinations do not materially improve the powers of the tartarized antimony.

As the doses of Tartrate of antimony and potassa, for the purposes of expectoration are so small, the tartrate should be free from adulteration. Its purity can be easily ascertained by dropping one or two of its crystals into a solution of sulphuretted hydrogen gas in water; when, if it be pure, an orange-coloured deposite will be formed on them: or the solution may be precipitated with acetate of lead or with lime water: in either case, if the tartrate be pure, the precipitate is soluble in nitric acid.

In employing the different Expectorants, frequent occasions occur for conjoining opium with them. In these combinations opium operates solely by its sedative influence: it certainly does not diminish the bronchial exhalation, as has frequently, but erroneously, been stated: on the contrary, it facilitates expectoration. This is to be attributed both to its increasing the natural exhalation of the lungs, and to its rendering the cough less frequent; and thereby diminishing the irritation which exists on the mucous membrane. It would be anticipating what I have to say regarding opium, under the head of narcotics, were I to attempt here an explanation of the manner in which it effects this; it is sufficient, in the present instance, simply to state the fact.

EMPLOYMENT OF EXPECTORANTS AS REMEDIAL AGENTS.

If we compare the class of Expectorants with many of the other classes of medicines, the range of their utility is ex-

tremely limited. It is, nevertheless, necessary that the employment of them should be properly regulated. Before prescribing an Expectorant, we must carefully consider upon what grounds we are to select the substance we intend to employ. We are aware that there are two distinct descriptions of Expectorants; one kind which operates by its stimulant properties, whether these act *directly* by an immediate impression upon the bronchial membrane, or *indirectly* through the medium of the system; and another kind, which takes off the constriction and diminishes excitement in the pulmonary exhalants, by exciting nausea. Now, the circumstances that would induce us to select our Expectorant from either of these classes must be connected with the nature of the disease affecting the pulmonary organs; its exciting cause; and the consideration whether it be a cough of inflammation and increased action, or whether it be connected with debility, and, in that case, be kept up by nervous irritation. In every pulmonary disease there is reason for thinking that the early symptoms are those of inflammation: Expectorants are then of little importance, except as auxiliaries in bringing on a crisis: but when this is overcome, or partly subdued, then the most salutary effects are obtained from expectoration. In this stage of pulmonary inflammation, the nauseating Expectorants are to be preferred. After expectoration, however, has been induced, and the inflammatory symptoms have been subdued, it is still requisite to continue the use of the nauseating Expectorants; for, as absorption is greatly promoted by nausea, it is necessary to relieve the chest of the superabundant mucus which, at this period, is poured out into the bronchial cells; and, therefore, those stimulants that experience has taught us are chiefly determined to the lungs, must be resorted to for the purpose of throwing off the burthen of mucus with which these organs are oppressed. It is easy to conceive that thickened, or, as they are termed, well-concocted sputa, which are generally sufficiently glutinous to adhere together in masses, will be more easily detached and ejected by a violent expiratory effort, than thin mucus, whether accumulated in the tubes or spread out upon their sides. The necessity, therefore, of

ascertaining whether the disease be one of excitement or of debility, is essential: it is necessary also to take into consideration the period of the attack, whether it be the commencement, the middle, or the termination, for which we are called upon to prescribe: for although each of these periods may be benefited by expectoration, yet the substances employed to effect this require to be very different in their characters, according to the period in which they are given. To illustrate these remarks, let us take, as an example, a case of pneumonia. In the commencement of the attack the secretion of the mucous membrane of the bronchial tubes is greatly deranged, and the tubes themselves are comparatively dry; and the inhaled air becomes, on this account, an injurious, instead of a healthful stimulus. As the disease advances, this state is overcome, either by bleeding or by a tendency to a spontaneous crisis; the quantity of the mucus is then greatly increased, and it is often tinged with blood. The most favourable symptom, in this state, is a free expectoration; the most unfavourable, the sudden cessation of it. Our object, therefore, is to aid this effort of Nature, or to produce an artificial state resembling it; not from any erroneous idea that the disease depends on some morbific matter which is to be thrown off, but on principles of a sounder pathology. It was from this erroneous notion of a morbific matter which required to be thrown off, that stimulants were formerly so freely and indiscriminately administered. We know now that there is no such matter; but that there is a diseased action in the vessels secreting the pulmonary mucus. At first there is a constriction of these vessels; but, as the disease advances, this is changed to a state of relaxation. The first attention of the physician is, therefore, to be directed to the inflammatory condition of the lungs; and if there be any reason for endeavouring to promote expectoration at this time, it must be effected by the gentlest means—such, for instance, as the inhalation of watery vapour, or by nauseating doses of ipecacuanha, or of tartar emetic and opium. Full vomiting in this state of the chest is also occasionally highly beneficial; and although, on a prima facie consideration of its mode of action, it may appear at variance with the

means just recommended, yet, by favouring a transfer of action, it often induces an increased secretion of mucus from the pulmonary exhalants, producing the most marked relief. To effect this benefit, however, the vomiting must be full, and maintained for a specific time, certainly not less than an hour. If, notwithstanding the employment of these means, the expectoration generally becomes too abundant, and there is danger from the obstacles it opposes to the free entrance of air into the lungs, then the stimulating expectorants are indicated—squill, ammoniacum, the balsams, the turpentines, ammonia, and the topical application of the expectorant gases.

The nauseating Expectorants are equally indicated on the same principle, in the commencement of catarrhs, especially in that epidemic variety of the disease termed influenza. After b'eeding moderately, and the administration of an emetic, the best results have followed the administration of small doses of ipecacuanha in combination with squills and opium: but when the febrile symptoms have disappeared, and cough, attended with a thin, frothy excretion remains, then the gum-resins, or the balsams and opium, administered in the evening and at bed time, are generally productive of the most beneficial results. The same precautions are requisite in the administration of Expectorants in the commencement and in the advanced stages of phthisis. But in all of these diseases expectoration may be too profuse; in which case we must resort to tonics and other means likely to support and bring up the vigour of the system. In the greater number of cases of asthma of a recent date, the disease begins with fever; a quick, hard pulse; a dry cough; oppression of the chest; and suppressed expectoration; and the paroxysm terminates with increased expectoration. This progress of the paroxysm led to the notion that it depends on the retention of the expectoration, and that the solution of the paroxysm must follow its appearance; and, consequently, squill, ammoniacum, and other stimulants were inconsiderately prescribed instead of the nauseating Expectorants, and were productive of injurious consequences. As long as the least suspicion of inflammation exists, the

stimulant Expectorants must not be prescribed: and it is only after this has subsided that squills, ammoniacum, and assafœtida, can be either advantageously or safely administered. On the contrary, in that variety of asthma which appears to depend on a state approaching to that of paralysis of the system of the par vagum, in which the bronchial cells, being deprived of their nervous energy, do not act sufficiently to aid the expulsion of the air in expiration, and, consequently, instead of aiding, prevent the necessary change required to be produced in the pulmonary circulation, the nauseating Expectorants would be hurtful; inasmuch as they tend to relax and keep up that state of diminished excitability which is the result of the morbid condition of the bronchial nerves. It is in such cases, and in the low stage of pneumonic inflammation, when the fever has assumed a typhoid character, and the lungs are loaded with mucus, that the inhalation of the irritant gases, the internal administration of the balsams, and more especially of Ammonia, are undoubtedly beneficial.

Under all circumstances, there are three general rules to be kept in view in administering Expectorants.

1. The surface of the body should be kept moderately warm, and even in a gentle or breathing perspiration.

2. Whatever determines to the kidneys must be avoided.

3. Purging is not only not to be promoted, but to be carefully guarded against; for, as the action of the secreting vessels of the lungs and intestines seem to alternate and to be opposed to one another, Expectoration is checked when purging occurs.

SECTION XIII.

EMETICS.—MEDICAMENTA EMETICA.

Syn.—Vomitoria.

EMETICS* may be defined—" substances which cause the ejection of the contents of the stomach by the mouth, independently of the stimulus of quantity, or of the influence of

* The term Emetic is derived from ἐμέω—I vomit.

any nauseous taste or flavour." This definition is a modification of that of Dr. Murray, who adds, "or of any narcotic or acrid power:" but as the real principle which enables emetic substances to produce their effects is unknown, it is going, perhaps, too far to affirm, in a definition, that this is neither *narcotic* nor *acrid.*

When emetic substances, with a few exceptions, are taken into the stomach in a certain quantity, they do not immediately operate; and the stomach remains for some time undisturbed. Their operation is preceded by an uneasy sensation, sometimes attended with nausea; which increases and terminates in vomiting. But the influence of the Emetic substance, even before vomiting commences, is not confined to the stomach. As soon as the nausea is felt, the countenance becomes pale; and the pulse is diminished in strength, but it beats quicker and more irregularly than before. There is, occasionally, great anxiety, listlessness, depression of spirits, and a tendency to fainting: at length sweat breaks out; and, before vomiting take place, there is a peculiar uneasy sensation experienced at the clavicles. After the vomiting has begun, the face flushes; the pulse, although feeble, yet is quickened; and it remains so between each effort of vomiting, which occurs several times in succession, at short intervals, before it ceases. The nausea now subsides, either at once or by degrees, leaving a transitory feeling of depression, which makes the patient indifferent to every thing around him.

To understand the theory of vomiting, the general functions of the stomach should be known.

The stomach is amply supplied with nerves, derived from the par vagum and the great solar plexus; but, except at the cardiac orifice, it is not an organ of much sensibility. Its natural action is a gradual and regular succession of moderate contractions from the fundus to the pylorus; or, as it is termed, a peristaltic movement, by which the chyme or food changed by the digestive process is carried forward and pressed through the relaxed pyloric orifice into the duodenum.

In swallowing the food to convey it to the stomach, the pharynx is elevated by a peculiar set of muscles; and I am

anxious to direct attention to this fact, because the same state of parts occur in vomiting, the pharynx is elevated and the glottis shut; and both these parts remain in this state during the act of straining, until the ejectment of the contents of the stomach is effected, when the pharynx again falls, the glottis is opened, and a full inspiration takes place.

The food is received into the stomach on the left extremity of the organ. Here it remains until it is changed into chyme, and becomes the natural stimulus to the muscular fibres, or rather of the nerves, calling these fibres into action; and by their contraction it is pushed from the fundus to the pylorus. If the stomach be in a healthy condition, the pyloric orifice opens and the chyme passes into the duodenum: but, on the contrary, if the food be imperfectly digested, the pyloric fibres do not relax; they contract and forcibly push backwards, by an inverted action of the part, the chyme again into the fundus of the stomach, and sometimes even into the gullet, exciting eructations, or the return of the food into the mouth. This repulsion of undigested food, by the pylorus, appears almost an instinctive operation. Sir C. Bell considers it approaching to something like intelligence; but it evidently depends on the distinction between the influence of a natural and an unnatural or unaccustomed stimulus applied to the same part. When the chyme is perfected, it affords the *natural* stimulus; and the contraction, excited in the pyloric region of the stomach, is preceded by the relaxation of the fibres of its valvular orifice; but when the chyme is imperfect, or any foreign matter stimulates this region of the organ, the stimulus is *unusual;* no relaxation of the pyloric fibres follow, and an antiperistaltic movement of the viscus is the result. Although the stomach, also, is a highly irritable organ, yet it is not, as I have already stated, very sensitive; and we are not sensible of its healthy excitement and action; but any unusual excitement is rendered sensible by an uneasy feeling, if not by pain. From this cause, food of difficult digestion oppresses the stomach; for, although that portion of the food which has undergone the change of digestion or chymification may pass into the duodenum, yet that which is undigested does not pass.

The stimuli, which excite the muscular fibres of the stomach, are not immediately applied to these fibres, but to the contiguous coats. Between the villous coat, however, and the muscular coat there is the closest sympathy. Indeed, this is the case between all the coats; for if, in an animal killed by a blow and immediately opened, the peritoneal coat be stimulated, the muscular coat will contract in the same manner as if the stimulus were applied to the villous coat. When an Emetic is received into the stomach, it is supposed to operate by its local stimulating influence on the coats of the stomach; but I greatly doubt the correctness of this opinion. If this were the case, the time which elapses between taking an emetic substance into the stomach and its operation would be much shorter than it is; and there are circumstances which induce me to believe that, in every instance, unless from a mechanical irritant, the emetic substance must be taken into the circulation before vomiting be induced. We know that when tartar-emetic is introduced directly into the circulation—into a vein, for example—it produces vomiting sooner than if it had been swallowed; and an experiment of M. Majendie has demonstrated, that when vomiting has been produced by an Emetic substance, it may be stopped by pressure made upon the medulla oblongata, in the same manner as the convulsions caused by strychnia may be arrested by pressure on the motor tracts of the spinal marrow. Now, the inference that may be drawn from this fact is, "that the action of Emetics is not owing to any local stimulus on the nerves of the stomach, but to the action of the emetic substance, after being absorbed into the circulation as a direct stimulus, *ultra naturam*, to the origin of the nerves, whereby contractions of the stomach and the action of the other muscles concerned in the act of vomiting are induced. These nerves comprehend a branch of the eighth pair, the intercostal, and the phrenic nerves.

It may be enquired what is the nature of the irritation which excites vomiting? Is it mechanical? Does it depend on the physical character of the particles of the substance employed? or is it the result of some chemical or electro-chemical change? These are queries which cannot be sa-

tisfactorily answered: it is probable that there is something in the substance employed which has the power of irritating a particular set of nerves only; for, were this not the case, why should Emetic-Tartar, when injected into the jugular veins, excite vomiting?

Vomiting may be produced by a variety of causes. 1. It may occur from the food undergoing changes inconsistent with healthy digestion; from mechanical irritants lodging in the stomach; from tumors pressing on the pylorous; from inverted actions of the intestinal canal forcing the contents of the duodenum, particularly the bile poured into it from the biliary duct, into the stomach; from chemical acrids, or poisons, or emetics taken into it; or from any substance, even the mildest, when inflammation or ulceration of its coats augments its nervous irritability.

2. Vomiting may be indirectly induced by strangulations of the intestinal canal: by irritations arising from biliary or renal calculi imparted in the excretory ducts of the liver or of the kidneys; by titillation of the fauces; by inflammation of certain portions of the contents of the cranium—for example, by the arachnoid membrane covering the base of the brain; by repelled cutaneous eruptions; by emetic substances injected into the veins; by sailing, swinging, riding in a carriage, and other movements of the body; by pregnancy; by the influence of certain odours; and even by mental impressions.

Whichever of these causes produces vomiting, a specific action of the stomach and the consent of certain muscles of the thorax and the abdomen are necessary to produce the effect: thence the question, in what manner is vomiting effected? In replying to this query, let us *first* enquire what opinions have been advanced by others. M. Chirac* first suggested the idea that the stomach is passive during vomiting, which, he contends, is affected solely by the action of the diaphragm and the abdominal muscles: an opinion which was afterwards maintained by Duverney, Bayle, and John Hunter. M. Litre denied the influence of the abdo-

* Histoire de l'Academie des Sciences, 1686.

minal muscles, and maintained that the diaphragm is the chief agent in producing vomiting. Lieutaud and Haller supported the idea that the stomach is the chief agent; the former founding his opinion on having observed in a patient, who could not be made to vomit by the most powerful Emetics, that the stomach was greatly distended and insensible.

Sir Charles Bell* appears to hold, with some modifications, nearly similar opinions to those of Lieutaud upon this subject. "That vomiting," says he, "may be produced by the inverted motion of the stomach and œsophagus alone, is apparent from experiments upon living animals, where the abdominal muscles are laid open, and from cases in which the stomach has rested in the thorax, and yet been excited to active vomiting." He also states that the walls of a stomach in his possession "had become so thick that they could no longer suffer contraction by the muscular fibres; the consequence of which was, that, although the inner coat of the stomach was in a raw and ulcerated state, there was no active vomiting." Sir Charles, however, modifies this opinion by remarking, "that, when the stomach is excited to vomiting, there is consent of the abdominal muscles, by which they are brought into violent spasmodic action; not alternating in their action, as in the motion of respiration, but acting synchronously, so as greatly to assist in compressing the stomach: but," adds he, "at the same time, the action of these muscles, however forcible their contraction, cannot alone cause vomiting; nor has this action any tendency to produce such an effect on other occasions, in which the utmost contraction of the diaphragm and abdominal muscles is required to the compression of the viscera."

M. Majendie, in an able memoir, published in 1813†, endeavours to refer this operation solely to the influence of the diaphragm and the abdominal muscles; and thus supports the opinion of Chirac. In one of his experiments, he drew the stomach through an opening of the abdomen; thus freeing it from the influence of the diaphragm and abdominal muscles, and he found that vomiting could not be excited. He also

* Anatomy of the Human Body, vol. iv, p. 54.

† See also Precis Elémentaire de Physiologie, vol. ii, p. 110.

ascertained that, if all the abdominal muscles be removed, leaving the linea alba, vomiting still occurs, from the stomach being pressed, as he supposes, between that part and the diaphragm. In another experiment he states that he substituted a pig's bladder for the stomach, and nevertheless found that vomiting took place! He found that the division of the phrenic nerve weakens the action of vomiting, but does not altogether prevent it. These experiments prove—1, that the influence of the nervous system is essential for the production of vomiting; 2. that the abdominal muscles influence the ejectment of the contents of the stomach: but they do not satisfactorily explain the action of the diaphragm, nor the part which the œsophagus bears in the operation of vomiting.

Dr. Richard Harrison, in his Gulstonian Lecture, adopts the opinions of Chirac and Majendie, as far as regards the influence of the diaphragm and the abdominal muscles; but he adds, to this call upon the expiratory muscles, through the agency of the brain, and their consequent action, the contraction of the stomach itself. Now there can be no doubt of the agency of the nervous system in this operation; the only question is whether the excitement be first exerted upon the extremities of the nerves of the stomach itself, from which the impression is communicated to the brain by sympathy, and the auxiliary muscles be thus called into action; or whether, as I imagine to be the case, the impression is made upon the spinal marrow, from the absorption of the emetic substances, and through the influence of the nerves of motion to the respiratory muscles, so that all the machinery concerned in the operation is excited into simultaneous action.

Dr. Marshall Hall has endeavoured to prove that Majendie's assertions respecting the influence of the diaphragm are incorrect; and that the act of vomiting is in fact a forcible expiratory effort. He contends that if the diaphragm contracts, as Majendie affirms, the act of vomiting would be attended by inspiration; that the glottis in this case would be necessarily open, and that the fluids ejected from the stomach would be drawn into the larynx, and induce great irritation there—an event which does not occur in vomiting.

On the contrary, as M. Majendie admits, although he contends for the agency of the diaphragm, the larynx is accurately closed at the instant that the vomited matter is passing through the pharynx. Dr. Hall's explanation of the mechanism of vomiting is this :—" The contents of the thorax and abdomen are subjected to the sudden and almost spasmodic contraction of all the muscles of expiration, the larynx being closed so that no air can escape from the chest, and the two cavities being made one by the floating or inert condition of the diaphragm." The mere mechanism of vomiting, therefore, according to Dr. Hall, " differs little from that of coughing, by which indeed the contents of the stomach are frequently expelled : the larynx in the former is, however, permanently—in the latter only momentarily—closed; and there is doubtless a different condition of the cardiac orifice and of the œsophagus." In order to confirm his opinion, Dr. Hall made an opening into the trachea of a dog, who was excited to vomit by means of the subsulphate of mercury; during the act of vomiting, the air from the lungs was forcibly driven through the artificial opening. Dr. Hall, in his explanation, admits the influence of the œsophagus, and adds, " it is plain that the cardiac orifice must be freely opened; for mere pressure upon the viscera of the abdomen will not, in ordinary circumstances, evacuate the contents of the stomach. To effect this open state of the cardiac orifice, it is probably necessary that the diaphragm should indeed be in a relaxed rather than in a contracted state." There is much ingenuity and considerable truth in this theory of Dr. Marshall Hall; but still it does not really explain the mechanical operation of vomiting. The following opinion which I have formed may be regarded as a modification of that of Dr. Hall.

We must admit that the glottis is closed and that a powerful effort is made as if of expiration ; but this effort is not altogether that of expiration ; for, whilst there is a powerful and sudden contraction of the abdominal muscles, forcing up the whole of the contents of the abdomen towards the thorax, the diaphragm is fixed, owing to the closing of the larynx and the retention of the quantity of the air which the lungs contained at the commencement of the efforts. The dia-

phragm is thus prevented from ascending into the chest; and the pharynx being drawn up, as in the act of deglutition, opens the cardiac orifice of the stomach and forms with this viscus one continuous cavity. This open state of the cardiac orifice of the stomach, forming the œsophagus and the stomach into one continuous cavity, explains an observation of Majendie, that, "during the state of nausea which preceded vomiting in some of his experiments, air was drawn into the stomach." Now, if it be true that the cardiac orifice of the stomach is open, and the mouth, the œsophagus, and the stomach form one continuous cavity, it is evident that the external air, which is heavier than the air and the vapour contained in the stomach, will be necessarily forced into this organ by its mere gravity, as it would be into a receiver containing the vapour of water and little or no air. In this state, on the sudden compression of the stomach, by the abdominal muscles drawn forcibly inwards, the diaphragm being fixed, the contents of the stomach are directed upwards with a degree of force commensurate to the suddenness of the pressure upon its walls, and are thus ejected by the mouth. If this description be correct, it is evident that the act of vomiting is the result of the simultaneous action of all the muscles of respiration, at a moment when the glottis is shut and offers resistance to the ascent of the diaphragm. Dr. Marshall Hall is correct in describing vomiting as an expiratory effort; but this effort alone would not effect it, were there not the resistance which I have described opposed to it. The stomach, therefore, is in every respect passive; and it is not obvious that contraction of this organ forms any part of the process of vomiting: it is rather in a state of relaxation than of contraction. Thus, if a bag half filled with fluid, with an open tube attached to it, were suddenly compressed by any external force applied to it, the fluid would be ejected through the tube; but if at the time of this compression the bag was also contracting its general capacity, the impulse of the exterior compressing force would necessarily be diminished, and the impetus of ejectment considerably weakened.

Such is my view of this operation; but in whatever man-

ner it is accomplished, there can be only one opinion respecting the share which the nervous system has in the operation. "This act (vomiting) will not take place," justly remarks Dr. Paris*, "however forcibly the stomach may be goaded by Emetics, where the energy of the nervous system is suspended, as in cases of profound intoxication, or in violent wounds and contusions of the head; while, if the brain be only partially influenced, as by incipient intoxication or by a less violent blow upon the head, its irritability is increased instead of being paralysed, and vomiting under such circumstances is excited by the slightest causes."

The action of Emetics varies: some exert an immediate or *primary* influence on the stomach, whilst that of others is *secondary*. An emetic substance swallowed, or, under certain circumstances, applied to the surface of the body, produces nausea, which is debilitating; thence, the excitement of the habit is immediately diminished: the second effect is vomiting, or the forcible ejectment of the contents of the stomach; and, in effecting this, the influence of the Emetic is carried beyond the stomach: for the contents of the liver, being forced into the duodenum, and passing from that into the stomach, in the act of straining, are also ejected. Besides, by the same act, all the abdominal viscera are compressed; and, by a repetition of this cause, the blood is propelled more forcibly through these viscera, and the secretion of the fluids thereby increased and altered. The blood in particular is propelled through the vena portarum, and the secretion of bile, consequently, is both augmented in quantity and altered in its quality; the gall bladder and the biliary ducts are emptied; the pancreas and the spleen are similarly affected; even the kidneys are within the influence of its action, and the urine is increased.

The pulmonary system, as may be readily supposed, shares the influence of the act of vomiting on the general system; and the circulation of the blood through the lungs is thereby accelerated. But the lungs are also affected by their sympathy with the stomach, not wholly by the mechanical action of vomiting. Vomiting, we know, is sometimes caused by

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* Pharmacologia.

difficulty of breathing or dyspnœa, and this again by an affection of the stomach. The secreting and exhaling vessels of the lungs are excited by vomiting; and therefore emetic substances hold a place among the tribe of expectorants. Upon the stomach itself Emetics produce a change, and alter the state of the secreted fluids: thus they not only evacuate any superabundant acid contained in the stomach, but so change the action of the secretory follicles, that all acid totally disappears for the time. When an Emetic acts, after the contents of the stomach have been ejected, the next matters thrown up are the humours, which are the result of the irritant action of the Emetic upon the coats of the stomach, and which are secreted almost at the instant of their ejectment. This is particularly the case when the ejected matter is thick, viscid, or floculent. When there is much straining, these matters are tinged with cystic bile.

Emetics act upon the general system. They stimulate generally the heart and arteries. During the action of vomiting the blood is propelled not only more quickly through the arteries, but it is also returned with greater rapidity through the veins. Thence, the blood is more generally and equally diffused through the body, and of course local determinations and congestions are removed. How far these effects depend, in part, upon the absorption of the emetic substance, is yet to be ascertained. Emetics act as evacuants in other respects than in the simple ejectment of the contents of the stomach, the excretion of fluids from the exhalants is greatly promoted, and thence depletion is favoured. It is generally stated that they augment effectively the action of the absorbents; but this is doubtful, and it is more likely that the impulse which they communicate to the capillaries, preventing the deposition of fluids, so that those which are already deposited are removed without any increased energy of the absorbents; thence, nausea and vomiting, although apparently they augment absorption, yet merely prevent depositions; and thence, also, collections of fluids, tumours, and thickenings of membranes, often disappear after the operation of Emetics. In consequence of that law of the system, that all excitation is quickly followed by relaxation, Emetics also

produce a sudorific effect. By abating the force of the circulation, they are useful in active hæmorrhages.

Although all the substances classed as Emetics so far accord in their effects that they produce nausea and vomiting, yet, they differ in some subordinate circumstances. Thus they differ in the time required for their operation. The sulphates of zinc and of copper operate the quickest of the usually employed emetic substances; exciting vomiting when taken in a proper dose, almost as soon as they are swallowed. Tartar Emetic and the other antimonial preparations, and subsulphate of mercury, an Emetic now obsolete, operate quickly also, but less so than the salts of zinc and of copper. The vegetable Emetics require a much longer time for their operation than the saline. This difference in point of time is not satisfactorily explained. It has been supposed to depend on the solubility of the emetic substance in the gastric juice, and its application to the extremities of the nerves being thus facilitated; but there is no evidence of the action of the gastric juice in this manner. Substances which are already in a state of solution, and therefore require no action of the juices of the stomach to render them fluid, are influenced by the circumstances, whatever they may be, that produce this difference; and two substances held in solution in the same solvent, and conveyed into the stomach under the same circumstances, differ considerably in the time at which they operate. This is the case with the solution of Emetic Tartar and that of Ipecacuanha: the former acts more quickly than the latter; and supposing they were both administered in the solid state and the action of either promoted by solution in the gastric juice, it is probable that the vegetable substance would be the most readily dissolved, and consequently act most quickly; but the reverse is the case. The only way in which it can be explained is by supposing that both pass the pylorus, and that the antimonial preparation is more rapidly absorbed than the emetina of the ipecacuanha. The time required for the operation of different Emetics should be known to the physician, as much of the advantage expected from this order of remedies may depend upon this circumstance.

Emetics also differ in the degree and severity of their

effects. The saline operate more violently than the vegetable Emetics; but the latter produce a longer-continued and more severe nausea. It is not easy to account for these effects, unless we admit that, whilst the first impression of the saline emetic on the nervous system is the most energetic, it is more readily decomposed or thrown out of the system than the vegetable substance.

Owing to the violence of the muscular exertion which attends vomiting, some precautions are necessary in the administration of Emetics. Persons of torpid habits are more difficult to vomit by Emetics than those of irritable systems: they require larger doses; and, frequently, vomiting cannot be excited by the largest doses: when this is the case, Emetics cause great anxiety and uneasiness. Persons of a sanguine temperament are more easily excited to vomit than those of a melancholic: women, in general, are more readily vomited than men; children than adults; consequently, we find that, in febrile affections, vomiting in persons of such habits is a very common symptom. The cause of this diversity is not very obvious: but it is of importance to have some rule for anticipating the degree of difficulty or facility with which different persons are excited to vomit; seeing, as I have already stated, that those who are excited with difficulty suffer from pain and anxiety; and those who are easily affected are apt to be hurt by the ordinary dose of an Emetic.

As, during the action of vomiting, pressure is necessarily applied to the descending aorta, and, from the impeded respiration, there is a temporary interruption of the pulmonary circulation, the blood is returned with difficulty from the head: vomiting should not be excited in states of the habit predisposing to apoplexy and other affections of the head. From the pressure, also, upon the abdominal viscera, Emetics ought not to be administered to those afflicted with *hernia* or prolapsus of the anus or of the uterus; nor are they always admissible in the advanced stage of pregnancy. The spontaneous vomitings which attend the early stage of pregnancy, shew that this precaution is unnecessary at this period.

The debilitating effects of nausea sufficiently demonstrate, that Emetics are not to be given in states of much weakness.

The ancients were much addicted to the use, or rather the abuse, of vomiting. They employed Emetics as an adjunct to personal gratification; to enable them to relish the enjoyments of the table; and so far was this custom carried, that they sometimes evacuated from the stomach what they had eaten in one course, that they might be the more capable of enjoying that which was to follow. According to Seneca, "they vomited that they might eat, and ate that they might vomit." They employed Emetics before meals that they might be enabled to eat more plentifully; and often, they concluded a feast with an Emetic, to prevent the bad consequences of their gluttony*. They also regarded vomiting as a means of preserving the tone and vigour of the body; and therefore it formed part of the discipline of the Athletæ. But experience has fully proved the fallacy of this mode of reasoning, and the injurious effects of a frequent repetition of Emetics; which invariably produces debility and such an irritable stomach, that vomiting is often excited by the smallest change in the food: indeed, no means are so likely to induce dyspepsia as this custom.

With respect to the period for the administration of Emetics, we must be guided by the circumstances of the case which demand their employment. If there be no immediate urgency, the evening is the best time; for, as after the operation of an Emetic the body is exhausted, and there is an inclination to sleep, it can then be indulged. To produce vomiting with the least suffering, the dose of the Emetic must be sufficient, otherwise nausea with retching only, not full vomiting, follows the administration of the medicine.

It is the custom to give warm water during the operation of an Emetic. This certainly promotes its action, if the water be drank after each time of vomiting: but it is requisite to be cautious that too much be not given at a time. The stomach, when overloaded with fluid, is oppressed; and does not respond to the action of the abdominal muscles, but

* In one of Cicero's Epistles to Atticus, he describes a visit which he made to Cæsar at a villa near Rome; and he states that Cæsar paid him the high compliment of taking an Emetic before dinner, when he understood that Cicero intended to spend the day with him.

suffers greatly from the straining, and is in danger of laceration. There are several instances on record of this having occurred; but a query may be put—whether rupture of the stomach ever happened without the existence of previous disease? The quantity of fluid for an adult should not exceed two thirds of a pint for a draught: the fluid should be tepid; and, when there is reason to suppose that there is debility of the stomach, some bitter infusion should be employed to aid the action of the Emetic. If the operation of vomiting be severe and long-continued, it may be checked by solutions of neutral salts, especially sulphate of magnesia; or by citrate of potassa, formed and given in a state of effervescence; by a tea-spoonful of magnesia in a glass of sherry wine; by solid opium in small doses; and by the cautious administration of hydrocyanic acid.

When emetic substances are taken in excess, they sometimes produce very singular consequences; and these seem to be wholly independent of the nature of the substances: one of these effects, of not unfrequent occurrence, is inflammation of the extremities, followed by gangrene. The following case, illustrative of this effect, is detailed in the Journal de Medicine (tome xxxviii)—"A woman of a costive habit of body had unsuccessfully employed many means of purging herself: a surgeon, to whom she applied, administered a violent remedy, which operated both upwards and downwards. Cramps, convulsions of the extremities, and extreme anguish supervened. Immediately afterwards she was attacked with severe lancinating pains of the extremities; and ecchymoses appeared on different parts of the body. Gangrene attacked the cartilaginous part of the nose; the lower lip; the skin of the chin; the points of two toes on the right foot, and the great toe of the left foot; all of which successively dropped off." M. Barbier, who quotes the above case, relates the following, which came under his own notice:—"A woman of the Fauxbourg d'Amiens, having received a purgative remedy from an herborist, was attacked, after taking it, with incessant vomiting and purging, which rapidly reduced her strength: she was carried to the Hotel-Dieu: next day the point of the nose, the ears, and the cheeks be-

came of deep violet hue; and soon afterwards the same colour spread over the feet and the hands; and gangrene rapidly attacked all these parts: she lost one of her feet, and several toes of the other*.

All substances employed to produce vomiting may be ranged under two heads — *Direct Emetics* and *Indirect Emetics*.

Direct Emetics may be defined " substances which produce vomiting by an immediate impression on the nerves of the stomach." It may be asked—how can any direct action upon the stomach produce vomiting, if the stomach be a passive agent in this operation? I reply that, by the term passive agent, I do not mean to assert that the stomach is perfectly inert and insensible to the stimulus of all emetic substances; on the contrary, all irritants, whether chemical or mechanical, are capable of exciting the stomach to vomiting; but, nevertheless, in this operation, the stomach is not the active agent. This seeming inconsistency may be thus explained. When the stomach is in the performance of its natural function, the digested food is pushed forward to the pyloric orifice; but, if the chymification be not complete, it is again thrown back into the fundus; and, occasionally, even into the pharynx, producing eructation—a circumstance, however, which occurs only when the secreted juices of the stomach are in a morbid state; and, under this condition, the ejectment of the food is produced by circumstances resembling in every thing but degree, that produced by Emetics. In a similar manner, when a large dose of sulphate of zinc or sulphate of copper, for instance, is swallowed, its immediate application to the nerves of the fundus of the stomach produces a spasmodic contraction, which throws the whole contents of the viscus, mixed with the sulphate, upon the pylorus; but these are as rapidly returned, even before the relaxation, which must follow the spasmodic contraction, have taken place; and by this means the emetic substance, being applied to the nerves of the cardiac portion of the stomach, the muscles and every other part necessary for effecting vomiting are simultaneously called into operation, and vomiting takes place.

* Traité Elementaire de Mat. Medicale, par J. B. G. Barbier, t. iii, p. 328.

The suddenness with which direct Emetics operate is no argument against the truth of this explanation, which I offer as the only theory which, in my opinion, is capable of explaining the immediate influence of sulphate of zinc, sulphate or acetate of copper, carbonate of ammonia, and all other matters which cause immediate vomiting. These substances, when taken into the stomach, first hasten, in a spasmodic degree, that action of the organ which carries the food forward to the pylorus; and there acting, *contra naturam*, instead of opening the pyloric valve, they are thrown back upon the cardiac portion, the nerves of which, being suddenly impressed, call into play all those sympathies which operate to produce the action of vomiting. If this theory be admitted, it may be applied to explain not only the vomitings which powerful irritants produce when swallowed, but those also which occur in cancerous affections of the pylorus, and those which attend the early stages of pregnancy. Thus, in cancer of the pylorus, when food is taken into the stomach, no vomiting occurs until it is pushed forward to the pylorus, which, being morbidly excitable, throws back the food, mixed with acrid matters, the result of the disease, and these, acting on the sensitive extremities of the eighth pair of nerves, which are spread on the cardiac portion of the stomach, the muscles of the abdomen and those of the respiration are instantly called into action to relieve the stomach of the offending matter. During the early stage of pregnancy, again, the sympathy between the stomach and the uterus is such, that the disturbance of the former is in the direct ratio of the energy of the latter; digestion, therefore, becomes depraved; the chyme is imperfectly formed, and, mixed with the acrid secretion, is thrown back from the pylorus and applied to the cardiac nerves, and vomiting is necessarily excited.

Substances which act in the manner just described, scarcely enter the stomach ere they are ejected from it: they constitute *Direct Emetics*. Their operation is preceded by no nausea, neither is any left behind after it is completed. Emetics of this division, therefore, are adapted for producing full and immediate vomiting in those conditions of the habit in which the exhaustion caused by nausea would be injurious,

but in which it is nevertheless necessary to unload the stomach. They are also most useful in cases of poisoning, not only on account of the rapidity of their operation, but from their action not being followed by absorption, which in such cases would prove highly prejudicial.

2. *Indirect Emetics* are substances which enter the circulation previous to vomiting being excited: and, on this account, a certain space of time elapses after they are taken into the stomach before vomiting occurs. It is not easy to explain how their influence is directed to the stomach; but this is the case, even when, instead of being swallowed, they are injected into the veins. They consist both of organic products and inorganic substances. Indeed, whatever disturbs the energy of the brain to a degree sufficient to affect the stomach by nervous sympathy, and to call into action the muscles necessary to establish the act of vomiting, may be regarded as an *indirect* Emetic. Thus, the mechanical irritation of the uvula and velum of the palate with a feather or the finger; the motion of a carriage; swinging; whirling; sailing; and many narcotics, produce nausea and vomiting: and the same effects result from the inhaling of some gases.

TABLE OF EMETICS.

A. DIRECT EMETICS.

a.—AMMONIA.
b.—SULPHATE OF ZINC.
c.—SULPHATE OF COPPER.
d.—ACETATE OF COPPER.

B. INDIRECT EMETICS.

* *Organic Products.*

a.—ACRID VOLATILE OIL, contained in

Sinapis *nigra*	15. 2.	Cruciferæ.
Anthemis *nobilis*	19. 2.	Compositæ.

b.—CITISSINA, contained in			
Asarum *Europæum*	11. 1.	Aristolochiæ.	
c.—EMETINA, contained in the roots of			
Cephaëlis *Ipecacuanha*	5. 1.	Cinchonaceæ.	
Psychotriæ *emetica*	—. –.	————	
Richardsonia *Brasiliensis*	—. –.	————	
d.—SCILLITINA, contained in the bulb of			
Scilla *maritima*	6. 1.	Asphodeleæ.	
e.—NICOTINA, contained in the leaves of			
Nicotiana *Tabacum*	5. 1.	Solaneæ.	

** *Inorganic Substances.*

a.—HYDROSULPHURET OF AMMONIA.
b.—SALTS OF ANTIMONY.

SUBSTANCES WHICH OPERATE AS DIRECT EMETICS.

a. AMMONIA. *Solution of Ammonia.* CARBONATE OF AMMONIA. L. E. D.—The nature of this preparation has been already described. If the officinal solution, to the extent of half a fluid drachm, be administered in a cupful of cold water, and the same quantity of tepid water be swallowed immediately afterwards, vomiting is instantly excited.

The acrid nature of pure Ammonia when given in the quantity necessary for exciting vomiting, and also the untoward circumstances which have occasionally followed its administration, have led to the employment of the Carbonate of Ammonia in its stead, in doses from ʒss to ʒi. Both preparations, in smaller doses, and very largely diluted, may be used to quicken the operation of other Emetics.

When given in large doses, Ammonia and its Carbonate act as irritant poisons, producing inflammation of the mucous membrane. Among other recorded cases of the fatal effects of the improper use of Carbonate of Ammonia, Huxham mentions that of a young man, who had acquired the habit of chewing the solid Carbonate. It produced hæmorrhage from the gums, nose, and intestines: his teeth dropped out; hectic

ensued; and, although he discontinued chewing the poison, yet he died of extreme exhaustion, after lingering for several months. When the Carbonate of Ammonia has been taken by mistake, or in an over-dose, the best antidote, if immediately administered, is vinegar.

As an Emetic, Ammonia and its Carbonate have been found serviceable in those stages of chronic catarrh, in greatly debilitated habits, in which expectorants cannot with propriety be administered. In such a state of the system, vomiting aids in unloading the bronchial tubes, whilst, at the same time, if Ammonia be the Emetic employed, a salutary stimulus is given to the nervous system; and the expectoration, which is often suspended in such cases, is restored. In the variety of phthisis, distinguished by the term asthmatic, Ammonia, also, employed as an Emetic, always proves useful.

b. SULPHATE OF ZINC. *Zinci Sulphas*. L. E. D.—This is a powerful and certain direct Emetic, more safe than ammonia, and equally energetic in its effects. Keeping in view the explanation, which I have attempted, of the operation of direct Emetics, the action of Sulphate of Zinc seems to depend on the local irritation which it excites on the nerves of the stomach. It creates no nausea, and operates as soon as it enters the stomach, producing a single but copious ejectment: it is, therefore, well adapted for cases of poisoning, and to excite vomiting in the commencement of a paroxysm of ague, when we are desirous of breaking the morbid association, which keeps up the disease, by giving such an impulse to the system as will propel the blood to the surface and equalize the circulation. In cynanche tonsillaris, when abscess forms in a situation which cannot be readily reached by the knife, and yet does not seem disposed to break, and an Emetic prescribed merely to burst the abscess, the Sulphate of Zinc is preferable to all other substances. Dr. Marley recommends it strongly, in combination with alum, for pulmonary oppression and hæmoptysis. He recommends it to be given in doses of six grains, in the morning fasting. He says that it produces vomiting instantaneously, but not violently, leaving the stomach invigorated*.

* Treatise on Tropical Diseases. London, 1804, p. 557.

Dr. Senter, Dr. Burton, and Dr. Roberts, severally, bear testimony to its utility as an Emetic in phthisis. It is also an useful Emetic in dyspeptic affections*.

The dose of the sulphate, to produce full vomiting in an adult, is from gr. xv to ʒss.

c. d. SULPHATE OF COPPER. ACETATE OF COPPER. *Cupri Sulphas. C. Acetas.* L. E. D.—Both these salts of Copper operate as powerful direct Emetics, producing vomiting almost as soon as they are swallowed, without exciting nausea. They have been employed in the incipient stage of phthisis; and it is a curious fact that in this disease the sulphate will sometimes lie in the stomach for upwards of half an hour without producing vomiting, and then operate at once and as forcibly as when it acts in the usual manner. I cannot pretend to account for this effect. "It is remarkable," says Dr. Young, "that a very great majority of the cures of consumption, which are related by different authors, have either been performed by emetics or by decidedly nauseating remedies." Among other physicians who have prescribed these salts of Copper, Dr. Mackittrick Adair held a very sanguine opinion of their salutary influence. He gave first, as an Emetic, a pint of warm water, then a grain of Sulphate of Copper with a drop of diluted Sulphuric Acid, in half an ounce of water every other evening for three days, then every morning. Although I cannot bear testimony in favour of this mode of treating phthisis, yet, if Emetics are to be employed, the Sulphate or Acetate of Copper may be administered. Before the use of the stomach pump, both these salts of Copper, but especially the sulphate, were very frequently employed in cases of poisoning by opium and other narcotics, when the Sulphate of Zinc failed to rouse the stomach into

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* A curious fact regarding this salt is mentioned in the 12th volume of Thomson's Annals of Philosophy. We are there informed that a spider fed and was supported on this salt alone for a considerable time. It is, nevertheless, poisonous to man, when given in doses intermediate between the largest administered to produce a tonic effect, and those given to excite vomiting. In larger doses, its emetic properties prove the safety of the individuals who may take it. The antidotes for poisoning by Sulphate of Zinc are milk, albumen, and the cretaceous mixture, after the use of the stomach pump.

action. The dose is from ten to fifteen grains dissolved in three fluid ounces of water.

In cases of poisoning by the salts of Copper, after the stomach pump has been used, the best antidotes are milk, albumen, and ferrocyanate of potassa. In using the stomach pump, milk and water might be substituted for simple water.

2. SUBSTANCES WHICH OPERATE AS INDIRECT EMETICS.

* *Organic Products.*

a. ACRID VOLATILE OIL.

The Volatile Oil in this case is probably merely the vehicle of a peculiar acrid principle; but, as we have never been able to obtain this in a separate form, I feel authorized to adopt the term *Acrid Volatile Oil.* It is the emetic principle in the two following substances.

a. MUSTARD. *Sinapis Nigræ Semina.* L. D.—The analysis of M. Thieberge (vol. i, p. 241) ascertained the existence of an Acrid Volatile Oil in Mustard, which is obtained by distillation of the marc after the expression of the seeds to free them from the fixed oil, in the manufacture of the flour of Mustard. This Acrid Oil is powerfully excitant, and to its impression on the nerves of the stomach must be attributed the emetic property of Mustard. It operates quickly; but, from the powerful excitement which it induces on the vascular system, there is reason for supposing that the acrid principle is taken into the circulation; and thence, that the act of vomiting is the result of its secondary action, not that of its direct impression on the gastric nerves.

Mustard is a useful Emetic in cases of intoxication threatening apoplexy, and in Cholera *asphyxia,* Asiatic cholera, in which its excitant property proves beneficial after its emetic operation is over. In atonic gout, also, in which no irritation is more hurtful than that arising from crude undigested matters in the stomach, a mustard emetic proves highly useful, as the substance employed to excite vomiting in such a case should be of a warm, stimulant kind, the operation of which is not likely to be followed by debility.

If the flour of Mustard be genuine, a dessert-spoonful,

about two drachms, mixed in a sufficient quantity of water, will be found the dose for an adult.

2. CHAMOMILE FLOWERS. *Anthemidis Nobilis Floræ.* L. E. D.—A strong tepid infusion of these flowers, administered in doses of from f℥iii to f℥iv, operates as a powerful Emetic, and is well fitted for dyspeptic affections. A weaker infusion is a useful diluent in promoting the operation of other Emetics, when the stomach is weak and likely to be too much oppressed by the use of simple water.

b. CYTISSINA.

This substance has been already described (vol. ii, p. 111). It is the active emetic component of Asarabacca. It was discovered by MM. Chevalier and Lassaigne, who named it from having obtained it first from the seeds of the Cytissus *laburnum.* Besides Cytissina, Asarabacca contains an acrid oil, which probably aids the emetic powers of the plant. It is now rarely, if ever, employed, as it loses much of its activity by drying and keeping.

c. EMETINA.

This substance was discovered by M. Pelletier in 1817; but it was then known only in its impure state. It is procured by treating the powdered root of ipecacuanha with cold water until all the soluble matter is separated: the infusion is then to be concentrated by evaporation in a water bath, and subcarbonate of magnesia added in excess, after which the evaporation is continued to dryness. This residue is next to be treated with strong alcohol, which takes up only the Emetina and resin; the tincture evaporated to an extract; and this again treated with water, and the solution evaporated to dryness. The Emetina forms in brown scales, which are semitransparent, have an odour resembling caromel, and a bitter, slightly acrid taste. It strongly attracts the moisture of the air, and is consequently deliquescent.

In order to obtain pure Emetina, calcined magnesia is employed instead of the carbonate, and the mixture boiled. The precipitate is then washed in the filter with cold water, dried, reduced to powder, and acted on by strong alcohol.

The emetina thus procured is next to be converted into a salt, decoloured by pure animal charcoal, and the filtered solution decomposed by calcined magnesia. The precipitate, dried and powdered, is again to be acted upon by alcohol; and the Emetina obtained from the alcoholic solution by careful evaporation.

In its pure state, Emetina is white, pulverulent, unalterable in the air, scarcely soluble in cold water, more soluble in hot water, and soluble in alcohol, but not in ether. Its taste is slightly bitter; it displays alkaline properties by restoring the blue colour to litmus reddened with an acid; and forms with acids neutral salts, which, however, are little disposed to crystallize. Its taste is slightly bitter. It closely resembles narcotina when uncrystallized, but its solubility in ether readily distinguishes the latter. According to Dumas and Pelletier, it consists of

Carbon	64.57
Hydrogen	7.77
Oxygen	22.95
Nitrogen	4.00
	99.29
Loss	71
	100.00*

Sulphuric acid carbonizes and destroys Emetina: nitric acid changes its colour to a deep red, then to yellow, much nitrous gas is evolved, and the Emetina is converted into oxalic acid. Muriatic, phosphoric, oxalic, tartaric, and acetic acids, dissolve it without altering it: but gallic acid precipitates it from its solutions either in water or alcohol, and forms with it an insoluble, inert compound. The tincture of galls, owing to the presence of tannin, precipitates it with more energy than gallic acid. The tincture of iodine also throws down a precipitate in the solution of Emetina, the nature of which is not well understood. It is completely thrown down by the subacetate of lead; but, although the acetate also precipitates it, yet the precipitation is less complete; the acetic acid of the acetate opposing itself to the precipitation. It is also slightly precipitated by the proto-nitrate of mercury, the

* Annales de Chim. et Phys. t. xxiv, p. 181.

perchloride of mercury, and the muriate of tin. The effects of these reagents are sufficient to characterize Emetina as a vegetable principle, sui generis.

This peculiar principle, when given in doses of from a grain to three grains, produces full vomiting; and, as none of the other principles of ipecacuanha root produce this effect, there is no doubt that the emetic power of that root is owing to this substance. It is also contained in the roots of some other plants besides those of ipecacuanha.

There are three kinds of ipecacuanha known in commerce, the *brown*, the *grey*, and the *white;* but they may be, with more propriety, arranged into two kinds, *annulated* and *striated*. Of the first kind there are three varieties, the *brown*, the *grey*, and the *red*.

1. *Annulated Ipecacuanha.*

a. Ipecacuanha Root. Cephaëlis *Ipecacuanha* Radix. L. E. D.—This is brown Ipecacuanha. Before describing it, I may remark that the observation of Decandolle, that the word Ipecacuanha is generally used to imply *vomiting root*, is incorrect. The two first syllables, *ipi*, is the Peruvian word for *root*, and Cacuanha is the name of the district where this particular root was first procured; so that the name simply means the root of *Cacuanha*. Nevertheless, under this name very different roots are designated: all of them, however, possess the property of exciting vomiting. This root was first introduced into Europe, as an Emetic, towards the middle of the seventeenth century; but so little was known of the plant which yielded it, that the celebrated Ray believed that it was the root of a species of *Paris*, whilst Morison and Linnæus thought it was that of a species *Lonicera*, or honeysuckle. The general opinion, however, was that it was the root of a *violet*. At length, in the commencement of the present century, M. Brotera, professor of botany in the University of Coimbra, in Portugal, published, in the Transactions of the Linnæan Society of London for 1800, a description of the plant which produces *Ipecacuanha*, and figured it under the name Callicocca *Ipecacuanha*. Decandolle*

* See his Memoir, published in 1802.

afterwards examined the plant, and ascertained that it belonged to the genus Cephaëlis, and gave it the specific name of the Peruvians, *Ipecacuanha**. The genus Cephaëlis belongs to the natural order Cinchonaceæ. *Ipecacuanha* is a perennial plant, growing in forests and shaded, moist places, in Brazil and various parts of South America, where it is also cultivated, especially, according to Humboldt, in Badillas in New Granada. The *roots*, which are the parts of the plant medicinally employed, are creeping and horizontal, representing threads strung with small tubercles or rings closely pressed together. The cuticle or root is brown, with a white parenchyma beneath it, and in the centre a filiform woody axis.

The roots are termed, in the places where the plant grows, *Raicilla*.

A very vague and imperfect description of this plant was given by Margrave and Piso in their History of the Brazils, which was published in the sixteenth century: and the plant was unknown to European botanists until a dried specimen was sent, in 1764, by the distinguished Mutis to the younger Linnæus, who described the plant under the name of Psychotria *emetica*†. The most satisfactory information has been communicated by Dr. Martius, who, with Dr. Spix, travelled in the Brazils, under the auspices of the King of Bavaria.

The root of *annulated* Ipecacuanha (see cut), as it is imported into this country, is seldom so thick as a goose-quill, unequally and irregularly knotted and branched, and covered with a brown epidermis. It consists of two parts: *a*,

* Woodville's Med. Bot. 3rd edition, vol. v, p. 14. London Dispensatory, art. Cephaëlis. Richard, Hist. Nat. et Med. des differentes Espèces d'Ipecacuanha, 1820.

† This plant was then erroneously supposed to yield the true Ipecacuanha.

an *inert*, ligneous axis; and *b*, an *active*, thicker, cortical portion. The fracture is brownish and resinous; yet the root contains no resin. The taste is bitterish, acrid, nauseous, with a faint, herbaceous odour. In one thing this species is distinguishable from all the others—that the root is not a continuation of the under-ground, horizontal stem, but the offsets from that part of the stem.

The roots of this species of Cephaëlis, which supplies what is termed *Brown Ipecacuanha*, as well as the grey and the red Ipecacuanha, were long considered as the roots of distinct species of Cephaëlis; but they are mere varieties of the same plant.

The *striated* Ipecacuanha, however, is the root of a distinct genus, the Psychotria *emetica*, which is now seldom brought to Europe, although it is more employed in Peru than the root of the Cephaëlis Ipecacuanha. The genus Psychotria, although it resembles, in some respects, the Cephaëlis, yet its features sufficiently differ to constitute it a distinct genus. The Psychotria *emetica* is a small under-shrub, found in Peru and New Granada; the root is nearly horizontal, and as thick as a swan's quill, jointed at irregular distances, and furnished with a few fibrous radicals.

The roots of the Psychotria are not knotted like that of the Cephaëlis; are little branched, and are smooth. The epidermis is of a deep brown colour, striated; with the fracture brown and slightly resinous. This root is nearly inodorous; scarcely bitter; and its acrimony is felt only after it has been for some time swallowed. It is much less active than the root of the Cephaëlis.

From what has been said, it is perfectly evident, that although these different kinds of roots had been so long regarded as varieties of the same plant, yet even their physical or natural characters are sufficient to mark the difference. Besides these kinds, another description of Ipecacuanha has also been occasionally introduced into commerce, under the name of *White Ipecacuanha*. Its characters are too distinct to allow it to be mistaken for either of those already de-

scribed. The axis is thicker than the cortical part, and yellow; it is tortuous, sometimes branched, and occasionally rough; of a pale, whitish colour; has a nauseous, herbaceous odour; a starchy, insipid taste; and remarkably acrid. It is the root of the Richardsonia *Braziliæensis* of Gomez. Several other roots—as, for instance, those of several species of viola; in particular V. *canina* and V. *parviflora*, two species of Ionidium; the Cynanchum *Ipecacuanha*, and Euphorbia *gerardinna*—are also used as Ipecacuanha, and mixed with the roots of the Cephaëlis.

Such are the roots of the various plants which have been used under the name of Ipecacuanha. Those of the Cephaëlis alone demand our particular notice. Let us now see what part of this is *active* and what *inert.*

Various analyses of Ipecacuanha had been made at different periods; but it was not until 1817, when M. Pelletier published his analysis, that any thing satisfactory to the public had been offered upon this point. He ascertained that the active constituent of the Brazilian root is Emetina, which is in the proportion of 16 parts in 100, in the best specimens of the root: the other components exert no emetic influence, and are an oily or fatty matter—wax, gum, starch, traces of gallic acid, and woody fibre. The analysis of the ligneous portion afforded 1.15 only of Emetina, and that perhaps belonged to some portion of the cortical part imperfectly separated. Thence the propriety of separating the cortical from the ligneous part.

In Ipecacuanha procured from the Psychotria, there are 14 per cent. only of Emetina; and, in the White Ipecacuanha, it does not exceed 5 per cent.

Sixteen ounces of good Brown Ipecacuanha yield twenty-four grains of Emetina.

There are two methods of separating the Emetina, the simplest is that which I have described.

The soluble substances contained in Ipecacuanha are rendered evident in the aqueous infusion of the powder by reagents: thus, the infusion of galls added to it throws down the Emetina; iodine also displays it, the tincture throwing

down a reddish precipitate, which is a compound of iodine and Emetina.

Subacetate of lead throws it down in conjunction with the gum.

The salts of iron detect traces of gallic acid by deepening the colour; and perchloride of mercury displays the albumen.

From these results, it is evident that infusions containing tannin should not be ordered in composition with Ipecacuanha, neither should Ipecacuanha be prescribed in combination with acetate of lead or iodine.*

Ipecacuanha is exhibited in many forms; at present we have no occasion to notice any but those employed for emetic purposes. The powder is the preparation most used as an Emetic. The ligneous fibre is perfectly inert, and therefore should be separated in the pulverization—100 parts of the root should yield 30 of the cortical substance and 20 of the ligneous part or axis. The powder is of a bright grey colour, with a nauseous, disagreeable odour, and a bitter, acrid taste, which adheres to the throat. The dose of the powder, to produce full vomiting, is from ℈i to ʒss.

The watery solution is more active than the powder. The full dose ʒss is rubbed up with f℥vi of water; and $\frac{1}{3}$ of it given at the distance of half an hour, if the first or second dose do not produce vomiting.

The only pharmaceutical preparation which is used as an Emetic is the wine of the British Colleges. The wine of the London College, however, contains no wine—a feature peculiar to the medicinal wines of this learned body. In the wine of the other two colleges, the proportions of the root is one part to fifteen and sixteen of white wine. It would be preferable to employ Emetina in these preparations, as the other components of the Ipecacuanha root causes fermentation and the moulding of the vinous solution. The wine of Ipecacuanha operates mildly, and is useful in diseases of children, when full vomiting is required.

As a medicine to produce vomiting, the first effect of Ipecacuanha on the mucous membrane of the stomach is that

* The presence of the starch in the insoluble part in cold water is rendered evident by boiling a portion of this residue in water and testing it with iodine.

of a local irritant; Emetina is then absorbed, and produces that simultaneous action of the muscles of the abdomen, the thorax, and the diaphragm, which constitute vomiting. Sometimes, nevertheless, Ipecacuanha in any dose fails to produce vomiting—a circumstance which, if the drug be genuine, can only be attributed to idiosyncracy.

In administering Ipecacuanha as an Emetic, it may be given with the view of simply unloading the stomach, or of acting sympathetically on more distant organs, after it has performed its emetic effect. When it is prescribed with the first intention, it frequently operates also on the bowels, owing to some of it being forced beyond the pylorus in the first effort of vomiting; and, on this account, when added to jalap, the purgative properties of the drug are much augmented. Sometimes it determines to the surface after exerting its emetic effect. A question has frequently been discussed—Is it always indifferent whether Ipecacuanha or tartar emetic be given as an Emetic? The answer is not difficult. Ipecacuanha is preferable, in every instance in which the powers of the stomach are required to be maintained and yet vomiting is indicated; and, in cases in which there exists a chronic diarrhœa, there can be one opinion only as to the superiority of Ipecacuanha over tartar emetic*.

With regard to the dose of Ipecacuanha requisite to produce full vomiting, I have already stated the quantity for an adult to be from ℈i to ʒss: it is unnecessary to say that this must vary according to the sex and temperament of the patient. The dose for a young infant is a grain: from six to ten years of age, from 8 to 10 grains: and for advanced youth of both sexes, from 12 to 18 grains. Of the infusion made by triturating ʒss of the powder with f℥vi of water, f℥ii administered at intervals of half an hour generally cause full

* The employment of Ipecacuanha as an Emetic was first noticed by Piso, in 1618. A quantity of it was brought to Europe by a physician of the name of Legras, in 1672; but its introduction was opposed, and would have continued to be so, had not a French merchant of the name of Grenier, who transported one hundred and forty pounds of it to Paris in 1686, engaged Adrian Helvetius, a physician of Rheims, to examine its effects. Louis XIV aided Helvetius in introducing it as a remedy in dysentery. Helvetius received £1000 for his discovery. Soon afterwards it was used in England and Germany.

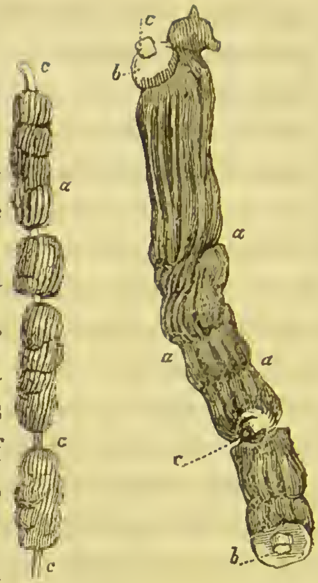
vomiting; for children, f℥ii of the vinous infusion may be given and repeated every fifteen minutes, until vomiting be produced.

With respect to the substitution of *Emetina* for Ipecacuanha, M. Majendie made several experiments, the results of which demonstrated that it acts more quickly than the entire substance of the root: its emetic effect is generally followed by sweating, and a tendency to sleep. It has not been much employed in this country; but the French physicians prefer it to Ipecacuanha. It is ordered in a solution of four or five grains in f℥vi of water, of which f℥ii are ordered to be taken every half hour until full vomiting be procured. That it operates through the medium of the nerves has been demonstrated by injecting a minute portion of its solution into the jugular vein; into the cavity of the pleura; into the tissue of the muscles; and into the anus of a dog. In all these cases vomiting was produced. If Emetina be overdosed, it excites, independent of violent vomiting and purging, the most dangerous, and often fatal effects. The lungs are found gorged with blood, and in a state approaching to hepatization; and the mucous membrane, throughout the whole intestinal canal, exhibiting appearances of inflammation. When symptoms similar to these occur, either from Emetina or from overdoses of Ipecacuanha, the best remedy is infusion of galls, which, forming an insoluble precipitate with the Emetina, neutralizes its action and renders it inert.

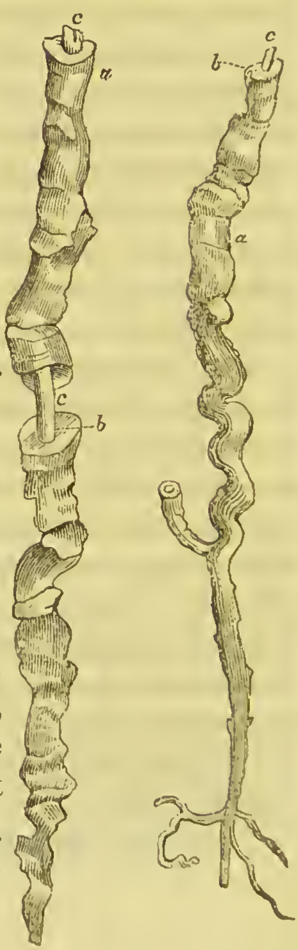
The powder of Ipecacuanha loses much of its activity by keeping, especially when it has been exposed to the light; and it is rendered inert also by long boiling in water. Owing to a peculiar idiosyncracy, some individuals are affected with symptoms of severe dyspnœa, or difficulty of breathing, by the odour of Ipecacuanha. Emetina is not liable to this objection: indeed there can be no doubt of the superior advantage of Emetina, both as regards the dose, the less disagreeable nature of the medicine, and its certainty of acting. And much advantage might result from substituting Emetina for the powder of Ipecacuanha, were an easy method of obtaining it discovered.

2. *Striated Ipecacuanha*, Psychotriæ *emeticæ* radix, (see

cut) differs from the ordinary or annulated Ipecacuanha in the cylindrical form of the root, which instead of the rings, present strangulations, *a. a. a.* at moderate distances, with the intervening spaces striated. The cuticle has a reddish-grey colour, the cortical part, *b*, is dark coloured, especially when moistened, and the woody axis, *c*, is white. The root breaks with a brown or blackish, scarcely resinous fracture; impresses a feeble taste of pepper when long chewed, but has no bitterness, and almost no odour. According to the analysis of Pelletier, 100 parts of this root furnish nine parts only of Emetina; twelve of fatty matter, with a large proportion of gum and fecula; and traces of gallic acid. On this account, it is considerably less active than the root of Cephaëlis; and consequently is little employed, even in France, where it was introduced to the notice of the profession by Merat*.



The roots of several species of Ionidium and Richardsonia, and that of Polygala *Poaya*, are also employed as Emetics in Brazil. The similarity of some of these roots of Cephaëlis Ipecacuanha root is shewn in the lower cut, copied from a plate of Von Martius†. The nearest figure is the root of a Richardsonia, but of what species Von Martius could not determine: it resembles the root of true Ipecacuanha in its epidermis, *a*, and the annular structure of its bark, *b*, which is also thick in proportion to the centre, *c*. The further figure is the root



* Dictionnaire des Sciences Med. art. Ipecacuanha.

† Specimen, Mat. Med. Brasiliensis, &c. 1824. Tab. 8.

of Ionidium *parviflorum;* and although it is less annular than the first, yet, from the thread-like aspect of the ligneous axis, *c*, and its cortical part, *b*, it would readily be overlooked in a specimen of Ipecacuanha. Neither of these roots is known in Europe. The roots of Polygala *Poaya*, those of Iodinium *parviflorum*, I. *Ipecacuanha*, I. *brevicaule*, and I. *urticæfolium*, and of Richardsonia *emetica*, have not been analyzed. M. Pelletier examined those of Richardsonia *Brasiliensis*, and procured 6 per cent. of Emetina—a proportion too small to render the root of any value as an Emetic.

d. Scillitina.

This substance, which has already been noticed (p. 160) as the active principle of the bulb of the Squill, is colourless, friable, with a resinous fracture; and equally soluble in cold water, alcohol, and vinegar. Vogel procured it by treating the expressed juice of the fresh Squill bulb with alcohol, then taking up the Scillitina and tannin from the alcoholic extract by water, separating the tannin by acetate of lead, and, after freeing the supernatant liquor from lead by sulphuretted hydrogen gas, evaporating to dryness.

Scillitina is deliquescent, and gives a viscosity to water resembling that of gum; treated with nitric acid, it affords mucic acid, which distinguishes it from gum. It has an intensely bitter, sweetish taste. It vomits and purges violently when taken in doses of a few grains.

In this country, Scillitina is not employed except in the state in which it exists in the bulb of the Squill. This bulb is ovoid-round, composed of fleshy concentric scales, covered with a thin brown coat. It often attains to a very large size, sometimes greater than that of the human, adult head. The scales, which overlap one another, are cut across and dried in a stove. The fresh bulb, when much handled, inflames and ulcerates: both in this and in its dried state, it is inodorous, extremely bitter to the taste, nauseous, and acrid. The acrimony is greatly diminished by drying the bulb. If the fresh juice of the squill or the decoction of the dried bulbs be tested with subacetate of lead, a curdy precipitate indicates the pre-

sence of gum; that of tannin is demonstrated by gelatin and persulphate of iron; and the salts of lime by oxalate of ammonia. If the insoluble part of dried squill be digested in muriatic acid, and liquor potassa added to the diluted filtered solution, a precipitate falls down, which is citrate of lime. Ether, when digested on dried squill and evaporated afterwards on water, leaves on the surface a thin pellicle of intensely bitter resinous matter, whilst a soluble matter mingles with the water. Notwithstanding the experiments of Vogel, I am disposed to regard this pellicle the active principle both of the squill and the Scillitina. According to the analysis of Vogel, squill contains 35 per cent. of *Scillitina*, 24 of *tannin*, 6 of gum, traces of citrate of lime and saccharine matter, and 30 of ligneous matter. Tilloy, who also analysed squill, found a fatty matter, besides those components which Vogel described. Squill is seldom employed as an Emetic; and is indeed a very uncertain Emetic, in some instances scarcely producing any influence, whilst in others a very few grains will produce violent vomiting. In cases where its emetic property is no objection, and does not interfere with its expectorant powers—as in hooping-cough, croup, and some other pulmonary diseases, in which much mucus is effused into the pulmonary tubes and bronchial cells—as it tends to promote absorption, it is found useful. When emetics are thought to be serviceable in ascites and anasarca, Squill has been supposed to be particularly indicated; but it is in no respect superior to other more commonly employed Emetics, such as tartar-emetic, in such cases. Alcohol and vinegar are the menstrua usually employed to take up the *Scillitina;* but the dried bulb may also be given in the form of powder to excite vomiting, in doses of from gr. iv to gr. xvi, or in that of tincture, from m. xxx to f℥i; and of the syrup, which is preferable to the oxymel, from f℥ii to f℥ss, repeated at short intervals until vomiting is procured. From the effects of reagents, it is obvious that the salts of iron and of lead, sulphuric acid, tartar emetic, and gelatin, cannot, with propriety, be prescribed in conjunction with Squill.

When Squill is overdosed, it operates as a narcotico-acrid

poison, causing vomiting, diarrhœa, griping, and bloody urine; and occasionally it also exerts narcotic effects. Vogel details some instances of poisoning which proved fatal, in which doses of the powder of Squill did not exceed gr. xxiv. Sometimes the ordinary dose of the syrup has been followed by vomiting, purging, and pain. In one instance, I saw an eruption resembling nettle-rash follow the administration of Squill; but this might depend on idiosyncracy. In Orfila's experiments, the dogs on whom he tried the poisonous effects of Squill, after having sustained the effects of poison for some hours, suddenly became tetanic, and almost instantly died. Orfila, with much probability, thinks that Squill exerts both its beneficial and injurious effects through the medium of the nerves.

e. NICOTINA.

Tobacco, of which Nicotina is the active principle, has a very powerful emetic influence, whether taken into the stomach or inserted into the rectum, or even applied to the surface of the body; but its operation is too difficult to controul, to permit it to be prescribed, under any circumstances, as an Emetic. The manner in which its poisonous properties display themselves has been already detailed; and I mention it here rather to caution against its employment than to recommend it as an Emetic; and this is the more requisite, as it lately has been recommended as a remedy in dropsy. Its poisonous effects, however, are more likely to follow the employment of it as an enema than as an Emetic. When an accident of this kind occurs, it is proper to know that the infusion or the tincture of galls throws down the Nicotina, and renders the infusion of tobacco inert, and consequently should be instantly administered.

* * *Inorganic Substances.*

a. HYDROSULPHURET OF AMMONIA.—When a current of sulphuretted hydrogen gas is passed through a solution of pure Ammonia, an union between the sulphuretted hydrogen and the Ammonia takes place, and Hydrosulphuret of Am-

monia is formed. It is of a greenish-yellow colour, exhaling a fœtid odour and impressing an acrid, disagreeable taste. It precipitates the solution of all the metallic salts: those of iron and of lead black, of copper a deep brown, of antimony orange, of mercury brick red, and of arsenic yellow.

In very moderate doses, this Hydrosulphuret causes nausea, vertigo, and vomiting. It is seldom, however, employed as an Emetic, unless it be requisite to produce at the same time a powerful sedative effect on the system. It is prescribed in one disease which is peculiarly distinguished by the augmented secretion of the kidneys and the saccharine properties of the urine, diabetes *mellitus*. The dose is from m. v to m. viii of the liquid Hydrosulphuret. The number of minims may be gradually augmented; but as soon as vertigo and vomiting are produced, the dose must not be extended.

b. ANTIMONIAL PREPARATIONS.

* *Sulphurets and Oxysulphurets.*

1. SULPHURET OF ANTIMONY. *Antimonii Sulphuretum.* L. E. D.—Grey Sulphuret of Antimony is found native. In order to purify it, the Sulphuret is first separated from the impurities with which it is naturally combined, then covered with charcoal and smelted in a reverberatory furnace, and afterwards the refuse removed; it is now run into moulds, and obtained in the form of loaves or masses, which are grey externally, and internally foliated or striated and brilliant. The largeness of the striæ, the compactness, weight, and volatility of the Sulphuret, mark the goodness of the specimen. Lead may be suspected in it when the texture is more foliated than striated; arsenic, by the garlic odour when the Sulphuret is thrown upon hot coals; and iron, when a brown colour is the result of its deflagration. The quantity of Antimony in the Sulphuret varies; but the average proportion is about 70 per cent. The analysis of Mr. Phillips makes it 73½ per cent. Sulphuret of Antimony consists of one proportional of Antimony = 64.6, + one and one half

of sulphur = 24, making the equivalent 88.6*. When Sulphuret of Antimony, in a state of minute division, is thrown into a bottle of chlorine, a powerful action is immediately induced, and a sesquichloride of Antimony results.

Prepared Sulphuret of Antimony *(Antimonii Sulphuretum preparatum* of the Pharmacopœias) is the sulphuret of commerce levigated with water on a porphyry stone. It is inodorous, insipid, of a dark leaden-grey hue, and stains the fingers when it is handled. It is insoluble in water and in alcohol; but is partially soluble in the vegetable acids, and consequently in wine. An emetic wine was formerly prepared by putting wine into cups formed of the sulphuret: the acid of the wine acted upon the sulphuret, and acquired properties sufficient to enable it to produce vomiting. When aided by heat, the sulphuret decomposes the sulphuric and the nitric acids; when the muriatic is poured upon it, the fluid is partly decomposed, the Antimony is oxidized, and, uniting with the remainder of the acid, forms a muriate; whilst the sulphur combines with the hydrogen, and forms sulphuretted hydrogen gas.

As an Emetic, Sulphuret of Antimony is uncertain in its effects. If the stomach be acescent, it operates with violence; when there is little or no acid present, it produces scarcely any action on the system. It was formerly much employed in scrophulous diseases and cutaneous affections; but the uncertain manner in which it operates has almost discarded it from modern practice. The dose of the sulphuret, to produce full vomiting, is from a scruple to half a drachm†.

2. PRECIPITATED SULPHURET OF ANTIMONY. *Antimonii Sulphuretum præcipitatum.* L. E.—To form this preparation, liquor potassæ is boiled on Sulphuret of Antimony, and the solution strained and precipitated by diluted sulphuric acid; this precipitate, washed with hot water, dried and rubbed to powder, is the precipitated Sulphuret of Antimony.

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* Berzelius, confirmed by Drs. Davy, Turner, Thomson.

† It was with the Sulphuret of Antimony that the Greek and Turkish ladies, to use a Scriptural phrase, "put their eyes in painting." The sulphuret was applied within the eyelids, and produced a peculiar softness of expression.

It is an inodorous substance, of a bright orange colour, and a slightly styptic taste, insoluble in water, and not readily acted upon by diluted acids.

Chemists vary in their opinion of the nature of *Kermes mineral**, which this preparation resembles. Berzelius fused Sulphuret of Antimony with black flux, and boiled the residue in water: he thus obtained Kermes, which, he affirms justly, is a hydrated sulphuret; but the precipitated sulphuret contains also some oxide of Antimony, the result of the process. According to Thenard, it consists of protoxide of Antimony 12.00, + Sulphuret of Antimony 76.5, + water 11.5, in 100 parts. In washing the precipitate, the water should be merely tepid: boiling water partially decomposes it.

This preparation is scarcely ever employed as an Emetic, owing to the uncertainty of its operation. If the stomach be acescent, it operates violently; but when this is not the case, it has been given to the extent of ten grains for a dose, three times a day, without any obvious effect. On this account, therefore, if circumstances should require it to be used as an Emetic, its operation should be promoted by dilution with tepid water slightly acidulated.

3. Glass of Antimony. *Antimonii Vitrum.* L.—When the sulphuret is exposed to heat, gradually raised, a large portion of the sulphur is driven off, in the form of sulphurous acid gas, and the Antimony is oxidized; and, on suddenly raising the heat, the whole is fused. It is then poured out and allowed to cool: and is thus obtained in the form of vitrified plates, semitransparent, and of a deep hyacinthine colour, inodorous, insipid, and consisting, according to Prout, of eight parts of protoxide of Antimony and one part of sulphuret of Antimony; or as an oxysulphuret. It is a harsh, violent, and dangerous preparation, and is never employed except for the purpose of preparing other antimonials.

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* M. Cluzel says that the finest kermes is formed by boiling, for half an hour, one part of powdered Sulphuret of Antimony, and twenty-two parts of crystallized carbonate of soda, in two hundred and fifty of water: then filtering the solution in a hot vessel, in order that it may cool slowly:—the kermes is deposited as it cools.

*** Protoxides with Acids.*

4. TARTRATE OF ANTIMONY AND POTASSA. *Antimonium Tartarizatum.* L. *Antimonii Tartras.* E. *Antimonii Tartras et Potassa.* D.—According to the directions of the British Pharmacopœias, this salt is prepared by combining the excess of acid in the bitartrate of Potassa with a protoxide of Antimony, so as to form a triple salt, that is, a salt with one acid base and two alkaline bases. In a comparison of the three formula of the British Colleges, that of the London is the simplest, that of the Dublin College the best*.

In the London formula, equal parts of the Glass of Antimonium and Bitartrate of Potassa are ordered to be powdered, mixed accurately, and boiled in a sufficient quantity of distilled water for a quarter of an hour; then filtered when cold, and evaporated so as to form crystals.

In this process the protoxide of the Glass of Antimony is dissolved in the excess of acid of the bitartrate of Potassa, and unites with the tartrate of Potassa, forming a triple salt, whilst some reddish sulphuret remains undissolved along with the silica, which the glass of Antimony usually contains.

One material objection to this process is, that the result must be necessarily modified by the nature of the glass of Antimony, which is sometimes adulterated with vitrified litharge; in which case, as scarcely any of the oxide of lead is dissolved, the quantity of the result is less than it should be, and it is also less pure. Mr. Phillips properly advises $\frac{1}{10}$ more of glass of Antimony than is ordered in the Pharmacopœia to be used, and the solution to be boiled for a longer time than is directed. Care must be taken not to push the evaporation too far, otherwise regular crystals of uncombined Tartrate of Potassa are formed in the mass of crystals of the Tartrate of Antimony and Potassa, which greatly weakens its emetic and other medicinal powers.

In the last edition of the Dublin College this salt is ordered

* The Process of the French Codex requires 125 parts of Glass of Antimony, 185 bitartrate of Potassa, and 1500 of water: from these 195 of tartar-emetic are procured.

to be prepared by boiling four parts of a protochloride, or nitro-muriatic oxide of antimony*, with five of bitartrate of potassa in fine powder, in thirty-four parts of distilled water, filtering while the solution is hot.

This process has many advantages over the London process. In the first place, the protochloride is always the same; for the impurities of the sulphuret from which it is formed, the zinc, iron, or lead being converted into muriates, remain in solution in the large quantity of water employed to precipitate the protochloride of antimony. The theory of the formation of the Tartrate of Antimony and Potassa is very obvious. The protochloride, when brought into contact with the water and bitartrate of potassa, decomposes a portion of the water, and is itself decomposed: the hydrogen of the water unites with the chlorine, and forms muriatic acid, whilst the oxygen combines with the Antimony and forms the protoxide, which dissolves in the acid of the bitartrate. The muriatic acid which is formed acts upon a part of the bitartrate, and, forming muriate of potassa, tartaric acid, and muriatic acid, are found in a free state in the solution.

Tartar Emetic, properly prepared, is in regular crystals of a small size, octohedrous with rhombic bases: transparent when newly prepared, but opaque when kept. These crystals are white, inodorous, and have a styptic, metallic taste. They are decomposed when exposed to a high temperature in conjunction with charcoal or any carbonaceous matter, and metallic antimony is left. Tartar Emetic dissolves in about fourteen and a half times its weight of water at 60°, and thrice its weight of boiling water. The newly made aqueous solution reddens the tincture of litmus; but, when kept, it is gradually decomposed. It is also slowly decomposed by the pure alkalies; but rapidly by the alkaline carbonates, the hydrosulphurets, the acetate of lead, lime water, the salts of lime, hydrocyanate of potassa, and some other of the metallic salts; the mineral acids; all metallic salts, the bases of which

* The sub or protochloride is prepared by boiling 20 parts of sulphuret of antimony in 100 parts of muriatic acid and one part of nitric acid, and pouring the strained fluid, when cold, into a large quantity of water, and washing the precipitate until every trace of acid be gone.

form insoluble compounds with tartaric acid; the decoctions of yellow cinchona bark, and of almost all vegetable astringents which contain tannin; for that it is not owing to the gallic acid is evident from the effect of tincture of galls. It is not, however, decomposed by meeting in the same solution sulphate of soda, or any permuriate of baryta, or any perfectly neutral salt, acidulated nitrate of silver, or acetate of lead: but if the salt be a double salt—as, for example, alum—then a copious precipitate is thrown down. According to the analysis of Mr. Phillips, the constituents of this salt are—tartaric acid, 44.21, + protoxide of antimony, 39.76, + potassæ, 16.03, = 100.00; or 1 tart. potassæ = 113.15, + 1 tart. acid = 66, + 3 protoxide of antimony (76.6×2) = 153.2, + 2 water = 18, equivalent 350.17*. Berzelius makes the proportions of these components in 100 parts of the salt to be oxide of antimony 27.10, + potassa 12.53, + tartaric acid 53.20, and water 7.17. It is a double salt, in strict language, or contains both a tartrate of antimony and a tartrate of potassa.

Tartar Emetic is very apt to be adulterated with bitartrate of potassa, sulphate of potassa, and similar salts. The crystals of Emetic Tartar can, however, be easily distinguished from those of bitartrate of potassa; for if the Tartar Emetic be dissolved in only fourteen parts of distilled water, the bitartrate or sulphate of potassa will remain undissolved. The quantity of Tartar Emetic may be also guessed at by dropping the suspected crystals into a solution of sulphuretted hydrogen gas: if they be the antimonial salt, an orange-coloured deposite will be formed on them, which will not occur if they be bitartrate of potassa. Or a solution of the suspected salt may be tested with a diluted solution of hydrosulphuret of ammonia, and its goodness judged of from the quantity of orange-coloured precipitate afforded. These tests, however, are far from being delicate, and lead to approximations only to the truth: but $\frac{1}{120}$ of bitartrate in Tartar Emetic may be detected by testing the solution of the suspected salt with acetate of lead suitably acidulated. This test is formed by adding to eight parts of the solution of acetate of lead three parts of strong acetic acid. The pre-

* Turner, from the analysis of Thomson, Phillips, and Walquist.

cipitation by this test is slowly formed: but it is certain, if any of the bitartrate be present. If any sulphate be present, it will be readily detected by muriate of baryta; if a muriate, by acidulous nitrate of silver. Its purity may be also suspected if the crystals deliquesce. The most frequent adulteration is bitartrate of potassa; in consequence of which, the drug should never be bought in a state of powder.

Tartar Emetic was first discovered by Adrian Mynsicht, and first made known as a medicine in 1631, in his Treatise, Thesaurus Medico-Chemicus; but it was prepared before that period. It was originally prepared by boiling the bitartrate of potassa with an impure oxysulphuret, the *Crocus* metallorum, as it was termed.

The Tartrate of Antimony and of Potassa excites locally the surfaces to which it is applied, as is rendered evident by applying it in solution to the skin, and by the acute pain which it induces when taken in very large doses into the stomach. But Tartrate of Antimony and Potassa operates as an Emetic through the medium of the nerves; and perhaps never until it reaches the circulation. It proves Emetic, or purgative, or sudorific, according to the frequency of the repetition of the dose. Thus, when a grain, dissolved in a moderate quantity of water, is given every ten or fifteen minutes, it produces full vomiting: the same quantity repeated every three hours, purges; and every five or six hours, operates as a powerful sudorific. It is, perhaps, the best of the emetic substances to produce vomiting in the commencement of continued fevers. It is also given with advantage as an Emetic wherever continued nausea is likely to prove useful. Were this the place to extend our remarks on this preparation, beyond its influence as an Emetic, it would be easy to prove that it might supersede all the other antimonial preparations.

When overdosed, it excites violent vomiting, hiccough, a burning sensation at the stomach, with other symptoms of inflammation of the mucous membrane of the alimentary organ. When this occurs, the stomach should be directly evacuated by the stomach pump, and, in addition to the means employed, the patient should be urged to drink freely of a de-

coction of yellow cinchona bark, or of galls, or catechu. It is difficult, however, to say what is an overdose of Tartar Emetic, as the most extraordinary doses have been prescribed by Rasori in Italy, and other Continental physicians. It was a common practice to prescribe it in large doses, in the seventeenth century; but this custom fell into disuse and was only lately revived. Twenty grains, and in one case forty-eight grains, were given, in divided doses, in twenty-four hours, by Laennec, without producing any deleterious effect, and even without producing vomiting after the first day. I have frequently prescribed it in doses of from gr. ii to gr. iii every three hours, and have seldom found that vomiting was produced after the third dose. Dr. Christie, in a Treatise on the Nature and Treatment of Cholera, asserts that he has given ℈i at once, with the effect of exciting some vomiting and several watery stools. M. Rasori explains the power of sustaining such large doses, on the principle that a peculiar diathesis accompanies diseases of excitement, in which only such doses can be borne; and that it ceases as recovery takes place. Laennec, however, says that this power of endurance does not cease at the close of the fever, although it is diminished—a circumstance which, if the observation be correct, may be ascribed to the force of habit.

When Tartar Emetic proves poisonous, the symptoms closely resemble those of cholera; violent vomiting, diarrhœa, great pain and tension in the region of the stomach, and delirium: the body swells, convulsions supervene, and death sometimes results. I have seen these symptoms follow the administration of moderate doses in some habits. On the examinations of the body after death, the only appearances to explain the fatal result, are slight congestion in the brain, with a red, thickened state of the villous coat of the stomach, which has also been found covered with a tough mucus. These similar appearances in the duodenum are all the marks of previous excitement that have been observed.

From what has been said of the action of the cinchona bark, there can be no hesitation in believing that that infusion, and such astringent vegetable infusions and decoctions, are the best antidotes in poisoning by Tartar Emetic. Cases related

by Serres, in the work of M. Orfila, and by Dr. Sauveton of Lyons, were saved by this means. In cases, even of severe vomiting, from ordinary doses of Tartar Emetic, I have checked this inconvenience at once, by administering two tea-spoonfuls of tincture of cinchona bark in a small portion of water, every ten minutes until the vomiting ceased.

To prove that poisoning has taken place from the administration of Tartar Emetic, the following simple plan, suggested by my learned colleague, Dr. Turner, is perhaps the best that can be adopted. Collect the vomited matter, or the fluid that has been taken, dilute it with distilled water, and filter: then acidulate with a little muriatic and tartaric acids, in order to coagulate any animal matter that may be present, and to bring, as it were, the whole of the antimony into the fluid. The fluid is next to be filtered and treated with sulphuretted hydrogen gas, and the precipitate collected and dried. This is now to be placed in a tube, and a stream of hydrogen gas passed slowly over it, which, carrying off the sulphur, leaves the metal in its metallic state. To determine that the metal is antimony, Dr. Christison proposes to dissolve it in nitric acid, and again precipitate it by sulphuretted hydrogen to obtain the orange precipitate.

Tartar Emetic is administered either in the entire state, or in solution in water, or in solution in wine.

The Antimonial Wine, Vinum Antimonii Tartarizati of the London Pharmacopœia, is not a vinous solution. In former editions of that work, wine was ordered to be employed as a menstruum for holding in solution either the protoxide of antimony or the Tartrate of Antimony and of Potassa; and this is still the case in the Edinburgh Pharmacopœia. In the present editions of the Pharmacopœias of London and Dublin, no wine is ordered. This change has arisen from the varying strength and quality of the wine employed, which rendered the preparation uncertain in its powers. There was also another objection to the use of wine—the tartaric acid which it contains is attracted by the potassa of the triple salt, and, this being converted into a bitartrate, the affinity which retained the potassa as a compound of the antimonial salt is thus broken, and decomposition results. The an-

timonial oxide, when an inferior wine was substituted, was precipitated in combination with vegetable extractive; and the supernatant fluid, Dr. Paris remarks, was so destitute of any trace of the antimonial salt, that it displayed no evidence of it when tested with sulphuret of potassa. The composition of the preparation now under our consideration does not undergo such changes; but some alteration is likely to take place by time, in a preparation which, notwithstanding one fourth part of rectified spirit is added to the quantity of water employed, must still be regarded as an aqueous solution. An extemporaneous solution of Tartar Emetic is a better and more manageable and certain medicine than either the real wine of tartarized antimony or the solution now under consideration*: even if an emetic wine be necessary in the cases of children, and the Tartrate of Antimony and Potassa be preferred to ipecacuanha as the active ingredient, it is better to make the solution at the time when it is wanted, than to keep it ready prepared in either wine or weak alcohol.

THERAPEUTICAL EMPLOYMENT OF EMETICS.

The effects of vomiting, as I have already stated, are not confined to the stomach, but extend to the surface of the body; thence it contributes to the due distribution of the blood, when the balance of the circulation has been disturbed and congestions occur, such as are found in intermittents: they cause, as it were, a revulsion from the head and the chest, and aid absorption by the impulse which they give to the capillary system. In these periodical fevers, Emetics have been much and beneficially employed; often succeeding in checking, at once, the catenation of morbidly associated actions which constitute the paroxysm in agues.

It is, however, in the commencement of such fevers, before the habit, which often keeps up the disease, is fixed, and

* Originally, the wine of antimony was prepared by putting wine into cups made of sulphuret of antimony: the acid of the wine acted upon the oxide of the sulphuret, and dissolved enough of it to acquire an emetic property. It was afterwards prepared by dissolving glass of antimony, the fused protoxide of the metal, in wine. In both cases the character of the preparation varied with the strength and acidity of the wine.

when the strength is yet unimpaired, that Emetics prove salutary. They may, nevertheless, be requisite at later periods of the disease: but, then, they are rather indicated to relieve a loaded state of the stomach consequent on its weakened powers of digestion, than to check the progress of the disease.

With regard to the time of giving Emetics in intermittents, especially those of this climate, there can be no doubt that the best period is that before the commencement of a paroxysm, as the cold fit is approaching; or, if this period pass, as soon as the cold stage is formed; unless spontaneous vomiting supervene, in which case diluents only are required. This was the practice of the ancients, as related by Celsus*; and its propriety has been amply confirmed. How the vomiting in this case tends to cut short the cold stage and to induce the hot, I will not venture to explain; the common explanation is, that it depends upon the sympathy between the stomach and the surface; and that the vomiting proves a general excitant to the system. The sympathy between various parts of the habit—as, for example, the diaphragm and muscles of respiration, and the pituitary membrane of the nostrils—is very obvious: the same sympathy operates in the action of vomiting; and thence it is probable that the benefit which the Emetic produces may arise from its general excitant influence. We admit this explanation for want of a better; but it is little better than a cloak for our ignorance. The fact, however, is sufficient: an Emetic administered at the commencement of the cold stage of the intermittent paroxysm frequently prevents its accession, and even removes the disease. But if Emetics do not produce this desirable effect, they always tend to diminish the violence, and to shorten the duration of the disease. Emetics have been given during the hot stage, which is also thus sometimes cut short, and the sweating stage brought on; but this practice is attended with some risk; and the general state of the disease is not altered: for it is a fact, that the paroxysm, as far as regards its violence and duration, is much regulated by the severity and the duration of the cold stage.

* De Medicina, lib. iii—passim.

Something also depends on the type of the fever: thus, the most benefit from the use of Emetics is derived in tertians.

With regard to the kind of Emetic to be employed in intermittents, as the shock given to the constitution, although partly, yet, is not solely the cause of the benefit derived from their use, we should employ those which determine most effectually to the surface; and these are ipecacuanha and tartar-emetic. The choice of either must be regulated by the state of the patient. The antimonial produces fuller vomiting, but its ultimate effect is more debilitating; thence, in delicate habits, ipecacuanha is to be preferred. The usual method of employing Tartar-Emetic, in such cases, is to dissolve six grains in six fluid ounces of distilled water, and to administer a table-spoonful every ten or fifteen minutes until vomiting be induced: if this do not soon take place, diluting with acidulated fluids will give activity to the medicine and bring it on.

If an intermittent be not checked by the exhibition of one Emetic, at the period I have pointed out, it is improbable that the immediate repetition of it will prove useful: on the contrary, the debility which results is directly calculated to render the type of the fever of a worse description, that is, to change a tertian into a quotidian, and thereby, in shortening the intermissions, to protract the cure of the disease.

The same reason which renders Emetics serviceable in intermittents authorizes their use in continued fevers. We are not, however, to take this term in its most general signification; but, under continued fever, to discriminate whether the symptoms, in each variety, indicate or contraindicate the employment of vomiting: we must also attend to the intentions which should induce us to prescribe Emetics, as well as the choice of the substances to be employed as such, and their mode of operating.

With regard to the variety of fevers of the continued kind, in which Emetics are indicated, it is evident that in pure inflammatory fever little can be expected from them; and much danger may arise from the determination of blood to the head, which always attends the action of vomiting. In all cases, therefore, in which the phlogistic diathesis is pre-

sent, blood-letting should be employed previously to the administration of an Emetic, if it be at all allowable; but, in general, in these fevers, nauseating doses of emetic substances are preferable to their full action as Emetics. In synochus, or mixed fever, also, some caution is requisite, particularly in the commencement of the disease: in the latter stage, when the excitement is diminished, Emetics might be given with less risk; but in this period of a fever they will seldom fail to disappoint the expectations of the prescriber. It is in low fever, and especially in typhus, that this determination is not present in the commencement of the disease; and therefore Emetics are advantageously given, with the view either of cutting short the disease, or, if this cannot be effected, of alleviating the symptoms and facilitating our power of conducting the fever to a favourable termination.

In the majority of the instances of remittent and continued fevers, not purely inflammatory, the first approaches of the diseases closely resemble those of mild intermittent fever. If there be not a shaking fit, there are sensations of chilliness and partial rigors, which are followed by heat of skin, and this by perspiration; and in this state of the case, many instances are recorded in which the early exhibition of an Emetic has at once cut short the disease. It must, however, be admitted that other remedies have as much power, if not greater influence, in cutting short continued fevers: for example, the cold effusion; and it is perhaps the most useful practice to employ the effusion first and then the Emetic.

To produce the desired effect of cutting short a fever by an Emetic, we must look to those circumstances which constitute the natural crisis of fever, particularly the determination to the skin; and, in choosing an emetic substance, to select that which will not only induce full vomiting, but affect the skin. Hence the most useful Emetic in continued fevers is the Tartrate of Antimony and Potassa. But every kind of Emetic has occasionally been used in continued fever: if full vomiting only be wished for, perhaps Ipecacuanha is preferable to the Tartar Emetic; but the diaphoresis which follows the employment of the Tartar Emetic, and which is highly

beneficial in continued fever, is seldom produced when Ipecacuanha is administered, and therefore the antimonial preparation is preferred. Another objection to Ipecacuanha is, that it frequently passes off by the intestines—an effect which it is often of importance to avoid in this class of fevers. On the contrary, Tartar Emetic possesses every requisite for producing nausea, vomiting, and also of powerfully determining to the skin.

But, besides being given with the view of cutting short fever, Emetics are also given with a curative intention after the fever is actually advanced; and this has been the practice from the time of Hippocrates forwards. But it is in vain to attempt to cut short or to cure fevers which have run on beyond the fifth or sixth day. All that a practitioner can effect in such cases, is to moderate the severity of symptoms; and, to borrow the language of a distinguished teacher*, " to avert the tendency to death."

The circumstances, therefore, which chiefly indicate the use of Emetics in continued fever, are an early period of the disease, in which we may hope to cut short or to arrest the progress of the disease, affections of the stomach, foul or loaded tongue, thirst, and a dry, hot skin. Those which contraindicate their use are an inflammatory or phlogistic diathesis, determinations of blood to the head, an advanced stage of the disease, an irritable state of the stomach, demonstrated by frequent vomiting, stupor, coma, and severe diarrhœa.

With regard to the period of the day for administering Emetics in continued fever, in almost every case there is an exacerbation towards mid-day and another towards the evening; but these are not always obvious: I say, not always obvious; because, although most writers state that there is a double revolution, or two exacerbations and remissions in the twenty-four hours, yet one only is generally clearly observed: the exacerbation takes place towards evening, and the remission towards morning. The exacerbation is particularly marked by an increase of the pulse, thirst, headache, and dry heat of skin; and it is immediately prior to this accession of fever that Emetics are useful, sometimes preventing it alto-

* Dr. James Gregory.

gether, at other times diminishing its violence. The best time, therefore, for the administration of an Emetic, in continued fever, is the evening.

With regard to the modus operandi of Emetics in continued fevers, they may cut fever short in the commencement, by removing offending causes from the stomach; by giving such a general concussion to the system as may rouse all its vital powers into new action; and by restoring that balance of the circulation, the loss of which permits that state of collapse of the surface to take place which invariably forms one of the most striking symptoms in the early stage of fever. An equable distribution of the blood, particularly to the surface, seems indeed essential to health, in promoting the cooling of the body and assisting the due secretion of the bile, saliva, pancreatic, and similar fluids; and therefore an Emetic, by aiding these, contributes greatly to remove thirst, heat, and delirium, in fever. Upon the whole, the usefulness of Emetics in continued fevers is undoubted, when they are administered at a proper period of the disease, under proper circumstances, and when the emetic substance employed is of a nature calculated to maintain the effect on the animal œconomy which the vomiting induced has commenced.

The same state of the habit which forbids the indiscriminate administration of Emetics in inflammatory continued fever, equally demands the same caution in all diseases of febrile character connected with local inflammation. Emetics have, nevertheless, been much employed in this order of diseases. In all the species of cynanche, or affections of the throat, accompanied with fever, Emetics are frequently prescribed. In cynanche trachealis, or croup, in particular, they are supposed to be specially indicated. Some writers, as, for instance, Dr. Crawford, who wrote on the use of Emetics in this disease in 1770, and many subsequent writers, recommend them to be given in the earliest stage of the disease, whilst others urge the use of them to be delayed until the inflammatory state of the disease is in some measure subdued. Now it often occurs that symptoms of croup arise not solely from inflammation, but from a spasmodic state of the muscles of the larynx and glottis; and it is in this state that Emetics

are found to be most beneficial. When the disease is not of a spasmodic character, it is always advisable to begin with blood-letting, and large, repeated doses of calomel and purgatives, before giving Emetics. At the same time I must bear testimony to the efficacy of the early employment of Emetics, even before blood-letting had been employed, in many instances which have come under my notice, in families predisposed to the disease. In these cases the parents of the children, being aware of the nature of the disease, gave an Emetic to the little patient before sending for medical advice; and, in every instance where this practice was followed, much less assistance was required from the lancet than in those cases in which it was not adopted. In cases, however, in which a practitioner is early called in, and when the excitement and inflammatory spmptoms are sufficiently obvious, the preferable practice is to abstract blood before having recourse to the use of Emetics.

In ordinary inflammatory sore throat, cynanche tonsillaris, Emetics given early have often cut short the disease; and they seldom fail to afford considerable relief. This is particularly the case when there is much fever, and sometimes even when the system generally is but little affected; an Emetic sometimes affords more relief to the inflammation of the fauces than any local remedy that can be employed. In a more advanced stage of the disease, however, particularly if the inflammation run very high, they do harm: this remark, however, must be taken with some reservation. Lieutaud, and several other credible authors, have stated that they have seen patients labouring under acute inflammatory sore throat snatched from the jaws of Death by an Emetic; and I can conscientiously add my feeble testimony to the truth of this remark. If abscess have formed, in a situation beyond the reach of the knife of the surgeon, as soon as the abscess is ripe, nothing is so likely to cause its evacuation as the exertion of vomiting; and under such circumstances you may always prescribe an Emetic with a certainty of success. In this case, as there is no necessity for desiring any effect from the Emetic beyond the bursting of the abscess, sulphate of zinc is to be preferred to any of the vegetable emetic sub-

stances, and to tartar-emetic. It sometimes happens that the abscess bursts in the night, and the greater part of its contents finds its way into the stomach; or other irritating matters—as, for instance, acrid mucus or saliva—may be accumulated in that vicus: in either case, the use of an Emetic is indicated, and its administration is always attended with beneficial effects.

In the malignant species of cynanche, that state of the throat in which the attending fever is of the typhoid type, and the tonsils are covered with sloughing ulcers, advantage is derived from the early use of Emetics; but in the advanced stage of this disease the debility attending their employment is a sufficient reason for proscribing their use.

The remarks which have been already made, on the injurious effects of Emetics in cases attended with determinations to the head, point out the impropriety of employing Emetics in phrenitis.

The same reasoning might be supposed to apply to ophthalmia; but in no disease, when it resists local blood-letting, purging, and blisters, have I seen so much benefit derived from Emetics. Something, perhaps, is due to the kind of the Emetic employed: I have generally given the tartar-emetic, both with the view of exciting full vomiting and also of keeping up a state of nausea and of perspiration after its action. With this view, I have generally ordered the Emetic to be administered in the morning before the patient rises from bed; and its use to be followed by a moderate purgative in the after part of the day.

In noticing the effects of Emetics in ophthalmia, it is proper also to mention their influence in relieving or rather preventing amaurosis. Although it is a disease in which there is often greatly diminished excitability of the optic nerve, and a consequent nearly complete or total loss of sight, without any evident disease of the eye—for, in general, there is both dilatation and an immoveable state of the pupil—yet some cases evidently depend on what, in modern language, would be termed gastric; and it is in these that Emetics prove so useful. The practice of treating such cases by vomiting originated with Richter; and such was his success in the treat-

ment of amaurosis, that individuals afflicted with it resorted to him from every quarter of the world. I cannot add the weight of my own experience in determining the value of Emetics in amaurosis; but I have had frequent opportunities of observing the effect of an Emetic in clearing the sight of those who had suffered in this respect from accumulations in the stomach and the first passages.

In some local swellings, as, for example, indolent buboes, Emetics have been found peculiarly well calculated to dicuss these glandular swellings; and their influence in this respect is not confined to the venereal swellings alluded to, but to many other tumefactions of the glands.

With respect to the propriety of employing Emetics in inflammation of the contents of the thorax, particularly in peripneumonia, physicians have been divided in their opinions. I should say that their employment is certainly not advisable in the commencement of the disease; as, in the act of vomiting, the blood being as it were accumulated in the heart and large blood vessels, its free transmission through the lungs must be impeded, and thence the inflammatory state augmented. In after stages of the disease, however, especially after the excitement has been reduced by a proper use of the lancet, when the cough is kept up by irritation in the bronchial tubes, when the expectoration is viscid, and difficult breathing is the consequence of the loaded state of the lungs, then Emetics prove highly beneficial. In infants thus affected they are particularly useful, as the stomach is generally disordered from the expectorated matter being swallowed; and, in clearing out the stomach, the pressure exerted upon the air tubes of the lungs in the act of vomiting, also, tends to unload the pulmonary tubes of the viscid mucus with which they are clogged. In convulsive coughs, such as characterize hooping cough and spasmodic asthma, experience has amply verified the utility of Emetics. In both of these affections there is much probability that the diseases have their origin in some morbid state either of the spinal cord or of the ganglionic plexus. In these diseases, Emetics may prove useful by the impression which they make on the

stomach, operating nearly in the same manner as a counter-irritant.

In another affection of the pulmonary system, phthisis, Emetics have been regarded as specific. They have been given in every stage of the disease. "It is remarkable," says Dr. Young, "that a very great majority of the cures of consumption, which are related by different authors, have either been performed by Emetics or by decidedly nauseating remedies*." They were employed by Hippocrates, by Galen, and Diocles, among the ancients; and by Bennett, Morton, Etmuller, Wainwright, Russell, Bryan, Robison, Marryat, Donald, Monro, Macbride, and others, among the moderns. Dr. Reid, from his own experience, never found their frequent repetition prove hurtful in phthisis, although he often gave them, daily, for weeks together: on the contrary, he remarks, "I have scarcely met with one instance in which the general health was not materially improved†." The confidence of Dr. Reid and Dr. Simmons in the use of Emetics was unbounded: they sometimes used the tartar-emetic, at other times ipecacuanha; and they assert that they have not only relieved, but cured the disease by these means: but truth obliges me to say that their method of treating this formidable malady has not succeeded in the hands of other practitioners. It is true that full vomiting mitigates many of the symptoms; as, for example, it lessens the cough, checks diarrhœa, and diminishes hectic. A sea voyage proves beneficial perhaps, in some degree, owing to the continued nausea it keeps up; but something is also to be attributed to the change of climate; and the equable temperature which can be preserved at sea. In the early stage of the disease, the efficacy of a sea voyage has been amply demonstrated; it undoubtedly merits our confidence as a curative agent; but the same cannot be averred of a continued course of Emetics; and, in the more advanced stages of the disease, we have no grounds for placing confidence upon any plan of treatment which has been hitherto sug-

* Practical and Historical Treatise on Consumptive Diseases, &c. p. 65.

† Essay on the Nature and Cure of Phthisis Pulmonalis. London, 8vo, 1782.

gested. Indeed the debilitating effects of Emetics would always prove an insuperable bar to their employment in the advanced stages of phthisis, notwithstanding the assertions of Dr. Reid and Dr. Foart Simmons to the contrary. If Emetics are necessary in this stage of phthisis, it must be very obvious that the sulphates of zinc and of copper, from the mode in which they operate, are more likely to prove less hurtful than either ipecacuanha or the tartrate of antimony and potassa. The precipitated sulphuret of antimony has been regarded almost specific in these cases; but this is by no means the case; and no preparation of antimony nor other emetic substance equals the tartrate of antimony and potassa in the treatment of phthisis.

In gastritis, nothing can be more injurious than an Emetic, even when it is of importance to expel the contents of the stomach. Instead, therefore, of Emetics, we must have recourse to cathartics, under such circumstances, to promote the passage of the offending matters into the bowels. The same objection exists to their use in inflammations of the intestines; indeed, in such cases, the nausea and vomiting which accompany the inflammation of any portion of the alimentary canal render it almost impossible to administer any remedy by the mouth.

In dysentery the indications are the reduction of the inflammatory action, locally affecting the large intestines; the evacuation of the acrimonious matters in the alimentary canal so as to effect the restoration of the natural fœces, and the restoration of the tone of the abdominal viscera. As far as regards the use of Emetics in dysentery, there is no difference of opinion among practitioners; the early periods of the disease are those in which they have been found most useful: the effect of contagion has been prevented; and in many instances, as in other fevers, the disease has been cut short. They are especially indicated when the excitement is considerable, and the skin dry and parched: thence the necessity of selecting those substances which by their nauseating qualities tend, besides unloading the primæ viæ, to determine to the skin, and also to relax the bowels. Both tartar-emetic and ipecacuanha, particularly the latter, have been judiciously

selected for this purpose by the best practitioners. The ipecacuanha should be given in substance, that it may pass the pylorus, even, if possible, before vomiting is excited. A set of experiments, to ascertain the comparative value of tartar-emetic and ipecacuanha in this disease, were instituted by Sir George Baker*. He found that the vegetable Emetics, especially ipecacuanha, were rather better adapted to answer all the indications required, than the antimonial. Whichever is employed, it should be given, in the first instance of the disease, to excite full vomiting; and afterwards in smaller doses, continued in combination with purgatives. To affect the surface, still smaller doses are requisite, and the combination is opium.

In acute rheumatism, some writers recommend the use of Emetics. They may prove beneficial after the excitement is moderated by cathartics and blood-letting in plethoric habits; but I have had no experience of their employment; and the disease generally yields to other means better calculated to relieve this painful affection than vomiting. In gout also, unless the stomach be much loaded, Emetics are not indicated; and although Dr. Macbride and some other writers think that they are serviceable at the commencement of the disease, yet, I have no hesitation in stating that in most cases of this complaint, in its acute or regular form, Emetics are quite unnecessary. In the atonic form of the disease, in which no irritation exists more debilitating than that caused by the morbid contents of the stomach, an Emetic will be found useful for the purpose of clearing out the stomach; but, in the choice of an Emetic for this intention, we must bear in recollection the necessity of selecting it from those that are of a warm and stimulant nature, and the operation of which is not followed by debility. Thus mustard and chamomile flowers are preferable in this case to ipecacuanha or the emetic tartar.

In the practice of the ancients, Emetics were employed to propel the supposed morbific matter, which was supposed to drive the eruption from the interior to the surface in the Exanthemata. As the theory was untenable, the practice

* Transactions of the Royal College of Physicians, vols. i and ii.

could not be supported on that ground; yet, at the same time, it must be admitted that, in many cases of this order of diseases, Emetics may be given with advantage. They are useful, for instance, in the eruptive fever of small pox, when the stomach is loaded, as often happens in this complaint; and, even when this is not the case, experience has clearly demonstrated their utility in casual small pox. In the inoculated form of small pox, and in its modified state, when it appears in those who have passed through the vaccine disease, Emetics are scarcely ever required to be given. In confluent small pox, attended with inflammatory symptoms, nauseating doses of emetic substances are admirably adapted for reducing the excitement; but full vomiting is neither advisable, nor in every instance is it safe. In measles, Emetics have been seldom employed; and indeed, except for the removal of peculiar symptoms which may arise incidental to the particular case, and the management of which does not come under the general plan of cure, there is nothing in the measles that is likely to demand the employment of Emetics.

In hæmorrhage, when the effusion of blood is accompanied with an inflammatory state of the habit, Emetics are likely to prove injurious; particularly if the flow of the blood be from any of the branches of the ascending aorta. The effort of vomiting occasionally causes epistaxis, or bleeding from the nostrils: when this already exists, therefore, Emetics would be improperly ordered; and they would be equally so in hæmoptœ, or spitting of blood: as it is well known that the pulmonary system is much irritated in the action of vomiting. But if full vomiting be prejudicial in hæmorrhages, nauseating doses of emetic substances have been found highly beneficial. Much of their utility, in this form of administering them, arises from the determination they produce to the skin, and the necessary result of this in promoting a more equable distribution of the circulating mass.

In almost every species of dropsy, Emetics have been employed; and this has arisen from the fact that the disease has been occasionally cured by spontaneous vomiting. Their use, however, in hydropic affections, is not free from disadvan-

tages: and the idea of a continued course of them is so revolting to most individuals, that few can be brought to submit to it*. Some species of dropsies—for example, ascites and anasarca—are much benefited by their use; and particularly when these watery depositions are the result of obstructions in some of the abdominal viscera, as the liver or pancreas. Squill has been particularly used in these cases; but it is certainly not superior to tartar-emetic, nor any of the stronger Emetics. When benefit arises from Emetics in dropsy, the abstraction of the effused serum is rapid, and consequently the parts require to be supported by bandages: whilst, during the intervals of their exhibition, and when the disease is evidently on the wane, tonics must be administered, and the habit supported by diet and proper regimen.

Jaundice is produced by obstruction of the duct which conveys the bile from the liver and gall-bladder into the duodenum: the bile which should be thrown out of the habit is reabsorbed, and a yellow colour given to the skin. This obstruction often arises from calculi passing from the gall-bladder, where they are formed, into the duct, and, being too large to pass, remain impacted there. The mechanical pressure upon the ducts, caused by the action of vomiting, may push the calculi forward into the duodenum; but the relaxation of spasm, which generally follows vomiting excited by substances that leave the sensation of nausea after producing vomiting, tend still more to accelerate the passing of such calculi; thence the antimonial Emetics, in particular, have been found useful auxiliaries in the treatment of jaundice.

In no disease have Emetics been more generally employed than insanity. Many of the best writers upon the subject contend for the propriety of their employment in all cases in which the strength of the patient is not much exhausted; and assert that the bodily health visibly improves under their influence. The latest writer upon this subject, Dr. Burrows, accords to a certain extent only in the opinion of the older writers, and adds that emetics do not produce the beneficial

* "Oportet quidam, hic monere quod leniara emetica nil agunt in Ascite, sed fortiera ex brevibus intervallis repetita palmam reliquis præripiant."—Boerhaave in Pract. Med. Ars. Art. Hydrops.

effects which follow their use, so much from their acting simply as evacuants, "but rather from the well-known effect vomiting produces on the circulation." The candour of Dr. Burrows, however, does not permit him to give more credit to the operation of Emetics than his own experience warrants; and he therefore says, "I must conscientiously declare that, after several years' perseverance, my confidence in Emetics alone, in cases of insanity, has been entirely dissipated. Still," he adds, "I have occasionally recourse to Emetics, but only as I would in other diseases—to free the stomach from troublesome ingesta, accumulated phlegm, or morbid bile; and sometimes to give activity to torpid viscera, and to rouse and emulge the general system." My limited experience confirms these remarks. I have often been disappointed in the employment of Emetics in insanity; and, unless under peculiar circumstances, have long discontinued their administration in such diseases.

In some diseases of a mental kind, however—as, for example, that species of hypochondriasis which borders on melancholia, and melancholia itself—the use of Emetics has proved more beneficial than in mania. In hypochondriasis, not only are the bowels torpid, but the stomach is apt to be deficient in the ordinary powers of digestion, the gastric juice is unequal to the process of chymification, and the viscus is apt to be loaded with viscid mucus. In this case, an Emetic, by clearing away the offending cause, invigorates the digestive faculty, and the influence of the remedy extending beyond the stomach, and improving the powers of assimilation, conduces greatly to the re-establishment of both corporeal and mental health.

"Emetics," says Dr. Burrows, "are occasionally useful, too, by interrupting intense abstractions and morbid hallucinations, and capricious resolutions. Where the urine has been retained from obstinacy, the operation of an Emetic will generally evacuate the bladder. In like manner it will sometimes act on the rectum when the fæces are withheld."

With regard to the choice of an Emetic in insanity, the best is tartar-emetic. It requires to be given in much larger doses than in most other diseases, a scruple often producing

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no effect while the congestion of the brain remains; whereas, if this be previously removed by the abstraction of blood from the head, a grain or two will produce full vomiting. In melancholia, however, there is some reason for rejecting tartar-emetic, even when full vomiting is requisite, on account of the nausea which follows its operation; for, in this state, the system is already much enfeebled, and to produce a further state of collapse may prove highly injurious, if it be not attended with dangerous consequences.

In one affection of the head, cephalea, which is characterized by periodical returns of excruciating pains, attended by an exquisite tenderness of the scalp, nothing is so serviceable as the administration of an Emetic at the commencement of the attack. Indeed, the whole disease has appeared to me to be a modification of intermittent fever, attended with local pains, connected with a morbid condition of the stomach; and the result of the administration of Emetics for its relief has fully confirmed me in the view which I had taken of the disease. The similarity between this affection and tic douloureux is so close, that the nerve has been divided with the view of obtaining permanent relief from its attacks, but without any benefit. Even in genuine tic douloureux; several of the American physicians have employed Emetics, and consider that they are decidedly, "above all other modes of treatment, the most useful in this painful and often intractable affection."

SECTION XIV.

CATHARTICS.—MEDICAMENTA CATHARTICA*.

Syn. *Purgatives.*

THE term Cathartics comprehends those medicinal agents which accelerate the peristaltic movements of the intestinal canal, and promote the evacuation of its contents.

When any of these substances are taken into the stomach,

* From the Greek verb, *καθαιρω*, I cleanse or purge.

it excites a slight degree of nausea; which, after a short time, is followed by an uneasy sensation in the abdomen, accompanied by a rumbling sound, and a fulness in the lower bowels; slight rigors are sometimes felt; but, just before the dejections take place, the pulse fills and the skin feels hot and dry. It is not, however, always requisite that the substances should be taken into the stomach; the same effects result if they be introduced into the rectum; and, in some instances, if they be merely applied to the skin. Cathartics, therefore, operate both by a local and sympathetic impression on the intestinal canal: but their influence is not confined to that canal; it is extended to the neighbouring viscera, and, in many instances, to the whole system.

In order to understand correctly the manner in which Cathartics operate, we ought to have some idea of the organization and natural functions of the part in which their influence is exerted.

The alimentary canal includes the stomach, the small and the large intestines. It is lined throughout with a mucous membrane, which forms undulated plaits, or *valvulæ conniventis*, that greatly augment the extent of its surface. This membrane is studded with numerous mucous follicles for secreting a viscid mucus which lubricates the surface of the canal, and which is greatly increased by the action of Cathartics. Covering this lining membrane is a muscular coat, consisting both of circular and longitudinal fibres. The whole canal is well supplied with blood-vessels and nerves; the arteries are secondary vessels from the aorta: the nerves are derived from the superior and inferior mesenteric plexus and connected with the great sympathetic; thence the intestines communicate both with the brain and the spinal column. Our knowledge of this nervous connection between the intestinal canal and the rest of the system enables us to explain the general effects of Cathartics.

With respect to the functions of this canal, when the chyme passes out of the stomach into the duodenum, it is there mixed with the bile and pancreatic juice; and the alimentary mass is moved into the jejunum, through which it passes slowly inwards; whilst the chyle, being separated from the

fæces, adheres to the villi, and is absorbed and carried into the circulation: this progress and absorption are continued through the whole length of the ileon, until the now nearly completely digested mass, mixed with the natural mucus of the canal, is pushed forwards into the cœcum. Received into the colon, the cells of this bowel give lodgment to the fæces, retain them, and prevent their too rapid descent into the rectum. In these, when the great intestines are torpid, scybula or hard fæcal balls are formed, by the fæces remaining too long in them; and it is only by the pouring out of the secretions of the intestine, when it is stimulated to increased action, that these are loosened or dissolved, and ejected from the body. But, besides the fæces and the secretions, a large quantity of gas, consisting chiefly of azote and sulphuretted hydrogen, is always present in the canal.

The intestines perform two distinct movements—a *vermicular* and a *peristaltic*. Upon looking into the abdomen of an animal suddenly killed by a blow on the occiput, or by hydrocyanic acid, we perceive a movement in the intestines, a drawing-in of one part, and an inflation and elongation of another, resembling, in some degree, that motion which proceeds from a snake or long worm coiled up: this is the *vermicular* motion. But, besides this movement, there is a direct contraction of the diameter of the gut, by the action of the circular fibres, which occurs in a regular series, from above downwards, through the whole length of the canal; each successive portion contracting before the former is completely relaxed: this is the *peristaltic* motion. By the joint action of both, the food is passed along the canal and ejected from the body. It has been supposed that, when any cause obstructs the progression downwards of the contents of the bowels, or the successive series of constrictions of the circular fibres are interrupted by any means, the natural action is then inverted, and an *antiperistaltic* motion takes place. Even in the natural or ordinary action of the intestines, the food is partly carried backwards as well as forwards; and thus it is more extensively applied to the mouths of the absorbents; whilst, nevertheless, the natural action is downwards.

The intestines are stimulated to action by matters within the canal: the immediate impression upon the mucous membrane is communicated to the muscular coat, and causes it to contract, by which the contents of the gut are pushed forward to stimulate another portion, whilst the former relaxes; thence, by such alternate contractions and relaxations, the ingesta traverse the whole of the canal with more or less rapidity, according to the degree of stimulus exciting these movements. Substances, therefore, which excite the increase of the natural action, are regarded as Cathartics, and remedial agents, within certain limits. During the operation of Cathartics, the natural accordance which exists between the contractions of the longitudinal and circular fibres is disturbed; and the result of this are colic pains, which are more or less severe according to the energy of the Cathartic.

When the stimulus is moderate—as, for instance, when it arises from the natural contents of the bowels—the villi, each of which is accompanied with an artery or vein, a lacteal or absorbing vessel, and a nerve, are erected and absorb the chyle; if it be in a small degree augmented, the interior coat pours out a greater quantity than usual of its natural secretion, or *liquor entericus*, a watery fluid resembling the gastric juice, and of mucus secreted by follicles on the interior surface of the canal; if the stimulus be still greater, the peristaltic motion of the bowels is accelerated, and their contents hurried through them; while, at the same time, there is a still more augmented excretion both of the *liquor intericus* and the mucus. Like every other organ, however, the intestines are stimulated, in the manner that has been described, within a certain limit only: beyond this point, inflammation is the consequence, and the results are altogether different. Substances that stimulate the intestines within the limits alluded to are justly regarded as *Cathartics*.

Cathartics act *locally* on the intestines; but their influence is extended to the neighbouring viscera, and, in many instances, to the whole system. When their action is confined to the intestinal canal, they prove beneficial, by restoring its suspended function. The first stools which occur after a purgative has been taken are similar to those produced by the

natural movement of the bowels; they are formed by the contents of the cœcum, the colon, and the rectum; the next are chiefly fluids, resulting from the irritation of the purgative on the mucous follicles and the exhalants of the intestinal tube, mixed with bile, and the drink taken to aid the action of the Cathartic.

But, besides their operation on the bowels, the influence of Cathartics is often extended to the stomach, propelling its contents into the duodenum: and they promote and increase the flow of bile and of the pancreatic fluid, by stimulating the excretory ducts of the pancreas and liver: for the stimulus applied to the excretory ducts of these organs is communicated to the organs themselves; thence a greater quantity of blood is determined to them, and an increased secretion is the consequence. The knowledge of this fact enables us to account for a result of frequent purging, which is too little attended to: the secretions, instead of being improved, are deteriorated, owing to the constant irritation communicated through the excretory ducts, hurrying the natural function of the liver, and thereby rendering the secretion imperfect, if not vitiated. I know a lady of rank who has too little to occupy and fill up her time; and therefore is so susceptible of every corporeal feeling as to imagine that she always requires the aid of purgative medicines, and actually takes a dessert spoonful of castor oil every morning. The consequence is, that the egesta never present a healthy appearance; and look as if she were suffering under what is termed a bilious attack.

Cathartics also influence the uterus; and, sometimes, the kidneys and the bladder: the secretion of the kidneys is generally diminished by their continued use, as the fluids which they cause to be discharged by the bowels would have been excreted by the kidneys. Their action upon the uterus is more decisive, owing to the contiguity of that organ to the rectum rendering it susceptible, especially in a diseased state, of the influence of stimulants affecting the rectum; thence some Cathartics, which are supposed to act specially upon the rectum, are regarded as Emmenagogues.

Cathartics differ with respect to the part of the intestinal

canal upon which they act: some particularly stimulate the abdomen, and thus promote the discharge of the contents of the biliary ducts—as, for instance, calomel and rhubarb; others, as aloes, exert their action on the colon and rectum; while a third class, the saline and oleaginous purgatives, increase the peristaltic motion of the whole intestinal tube; and thence operate quickly. No satisfactory explanation of the cause of this difference of action has yet been advanced, but the knowledge of the fact is of great importance in a practical point of view.

Cathartics are said to act generally when, besides the evacuation of the bowels, they cause copious discharge of serous fluid from the circulating mass. The suddenness of this abstraction, combined with the quantity discharged from the exhalants, produces a powerfully sedative effect on the whole frame; the force and velocity of the pulse are diminished, and febrile and inflammatory action is overcome, or at least greatly lessened. In some instances, indeed, as when Elaterium is administered, the discharge of watery fluid is so excessive, that alarming and even fatal effects have resulted. If the purging be long continued, the chyle is evacuated; and thence, in protracted diarrhœa, the blood loses its red colour, the surface of the body becomes pallid, and symptoms of exhaustion supervene.

Cathartics are supposed to excite the general action of the absorbents; and on this principle is explained the removal of extravasated fluids: even solid matters, the product of disease, are frequently removed by active purging; an effect attributable to a law of the system, by which a great discharge of serum is followed by an apparently increased action of the absorbents. I employ the term apparent, because it is problematical whether the absorbents be excited, or the capillaries. In either case the effect is the same.

Although the primary influence of Cathartics, that of exciting the alimentary canal, is shared by all of them, yet they differ considerably in their secondary effects. Some operate quickly, others very slowly; some produce nausea, griping, and tenesmus; others operate with less sensible impression; some cause one copious evacuation only; others repeated

stools. The doses also, in which Cathartics are administered, greatly modify their action. Some, when given in large doses, only slightly augment the peristaltic motion of the bowels: others, when given in minute doses, produce numerous watery stools, with pain and great irritation; some act so violently as occasionally to excite inflammation. Cathartics have been accordingly divided into *Laxatives*, *Purgatives*, and *Drastic Cathartics*. But, besides these divisions, the frequent necessity of administering Cathartics by the rectum, renders a fourth division requisite, namely *Enemata*.

But Cathartics also cause purging when they are only applied to the skin. Thus, if a cataplasm of rhubarb be laid upon the pit of the stomach of a child, the bowels will be emptied; and aloes applied to any abraded surface, produce the same effect upon the rectum as if the medicine had been taken into the stomach. This method, however, of exhibiting cathartics is rarely or never employed, although it may be taken to advantage under certain circumstances; when the patient, for example, obstinately refuses to take medicines by the mouth, as sometimes occurs in childhood and in insansity, and when more harm than benefit would follow the employment of force. On the same principle, placing one or two drops of Croton oil on the tongue purges briskly when the powers of deglutition are suspended and injections do not fulfil the intention of the practitioners.

Before describing each of the divisions above enumerated, it is proper to make a few remarks upon the nature of the matters evacuated. They vary considerably in *colour;* they are either brick-red, brown, yellow, greenish, slate-coloured, clay-coloured, black, or nearly white; in consistence firm or scybalous, soft, pultaceous, or watery: and with respect to odour, more or less fœtid. They may be also mucaginous or puriform: the former depending on the excitement of the secretory action of the crypts of the mucous membrane; the latter on ulcerations of that membrane. According to the character which the discharges presented, the ancients classed purgatives under the heads *hydragogues*, *phlegmagogues*, *cholagogues*, and *panchymagogues*. If watery stools were pro-

duced by the excitement of the intestinal exhalants, the cathartic which caused it was regarded a hydragogue*: if the stools were glairy, owing to the excitement of the mucous follicles, it was a phlegmagogue†; if much mingled with the secretion of the hepatic organ, a cholagogue‡; and, finally, a panchymagogue§, when the evacuations which it caused were mixed nearly equally with the humours of the intestinal canal. But it was an error to ascribe this effect to the substances employed; the same cathartic will produce bilious stools in one person, and mucous or serous in another; or, administered even to the same person at different times or under different circumstances, will produce distinctly opposite effects. Nevertheless, as I have already stated, some cathartics act upon one portion of the intestinal, others upon another; and effects result connected with the secretions of the portion acted upon, which greatly modify the character of the evacuations. This truth was firmly grasped by the ancients, who ascribed almost all diseases to some peccant humour which required to be expelled; and they believed that purgatives possessed this power in an eminent degree. The cathartic was therefore selected which was best fitted to expel the particular humour on which the disease was supposed to depend. If, after employing it for a proper length of time, the disease still continued, it was then concluded that something remained to be thrown out, and the course of purgatives was renewed.

Let us now examine the characters of each of the divisions of cathartics.

1. *Laxatives* are partially digestible substances, which gently stimulate the inner coat of the intestinal tube and moderately quicken the peristaltic action. They merely remove irritating matters from the bowels, and thereby diminish what has been termed the tension of the system, and abate the disposition to febrile action: they are on this account employed in cases in which active purging would prove detrimental. A state of the bowels requiring such aid frequently occurs, independent of disease. Thus, in the ordinary state of the habit, the accumulation of the fæces in the

* From ὕδωρ, water, and ἄγω, I eject.

† From φλεγμα, phlegm, and ἄγω.

‡ From χολὴ, bile, and ἄγω.

§ From παν, all, χυμος, juice.

rectum generally occurs daily at the same hour, and a sensation is excited which indicates the necessity of evacuating the bowels; but if the usual period be permitted to pass, the contents of the rectum are again partly thrown back upon the colon: the habit of evacuating them at a certain time having been interrupted, a torpor of the great intestines follows, and some additional stimulus, such as that afforded by a laxative, is required to re-excite their ordinary action. In children, and also in individuals of delicate habits of body, the debility which, more or less, always follows the use of the more active cathartics, would often prove highly detrimental, and therefore laxatives are employed. Some laxatives owe their effects to a mechanical property; as, for example, bread made of flour which has not been bolted, or freed from all the bran, proves aperient, owing to the spiculæ of the horny testa of the grain which have been left in the flour. These pass the pylorus unaltered, and stimulate mechanically the alimentary canal. The distention of the stomach by a large quantity of fluid is often followed by the evacuation of the bowels. But many laxatives owe nothing to their physical properties: this is the case with almost all vegetable substances containing the saccharine principle, such as sugar, manna, honey, the juices of ripe, particularly subacid, fruits, malted grain, fermented liquors, bland fixed oils, sulphur, and magnesia.

In the same division, it may be contended, might be placed all the purgatives; even, with some exceptions, the drastic cathartics, by apportioning the dose and largely diluting them, or combining them with bland, inert substances calculated to sheath their acrimony; but the substances which are, properly speaking, laxatives do not owe their aperient property to quantity.

2. *Purgatives* are indigestible substances which, taken into the stomach or introduced into the rectum, irritate the coats of the intestines and augment their peristaltic movement. The action of Purgatives is, therefore, merely an increased degree of that of laxatives; but, besides augmenting the peristaltic action of the intestinal canal, they stimulate their secreting surfaces, so that a larger quantity of fluids than is usual is excreted by the intestinal exhalants.

The necessity of employing Purgatives is founded on the

same circumstances as those which demand the use of laxatives; but as their operation also reduces the powers of the system, they are indicated in diseases of excitement; in which the mere evacuation of the alimentary canal of its contents is a secondary consideration. In continued torpor of the bowels, giving rise to an accumulation of fæces in the larger intestines, more active stimulants of a cathartic nature than simple laxatives are requisite; thence, in such cases, Purgatives are employed. But, as I have already said, the most important application of Purgatives is not to obtain their operation on the intestines themselves, but the influence which they exert upon the other parts of the system. In this respect they form a part of what has been termed the antiphlogistic plan of treatment, that which is chiefly applicable to inflammatory diseases. By diminishing arterial action, they promote absorption. It is this effect of the purgatives which renders their frequent use productive of wasting of the body. Purgatives accelerate the pulse before they operate; they develope animal heat, cause thirst, diminish perspiration, and, after their operation, induce sleep.

3. *Drastic Cathartics* are also indigestible substances which operate in the same manner as purgatives, but with greater energy, and affect the nerves of sensation more than either laxatives or purgatives, frequently causing griping or tormina, nausea, and vomiting. This influence, however, on the sensitive nerves is not essential to the fulfilment of the intention with which Drastic Cathartics are administered. Drastic Cathartics are generally resinous or resino-extractive substances.

Cathartics have been described as belonging to three genera; yet it is impossible to mark the limits where one set terminates and the other commences; for all, with a few exceptions, may be arranged under one head; the difference depending rather on the energy of their action than on any specific or peculiar mode of operation. The effects, indeed, of Cathartics depend on such a variety of circumstances, that laxatives may operate in some cases with violence, and a mild and scarcely sensible action may follow the administration of the most drastic Cathartics. A question here presents itself,

namely, are Cathartics absorbed? We know that the colouring matter of rhubarb can be detected both in the urine and in the cutaneous perspiration; we know, also, that an infant at the breast of a nurse who has taken a dose of senna is purged; the flesh of birds who feed on the berry of the Rhamnus *catharticus* has a purgative property; and inorganic cathartic substances, such as sulphate of potassa, have been detected in the blood contained in the venæ portæ, the inferior cava, and the right ventricle of the heart*. The fact of absorption, therefore, must be admitted; but, at the same time, it is undoubted that Cathartics operate independent of absorption.

Let us now enquire what are the circumstances which modify the operation of this class of medicines.

a. Quantity modifies the operation of Cathartics; and this is so obvious as scarcely to require any comment. The rule, however, is not general; as some drastic purgatives—for instance, elaterium and croton oil—exert their full effects in such minute doses, that it is impossible to reduce their action to that of a laxative. On the other hand, some laxatives—as, for example, sugar, manna, and magnesia—cannot in any dose be brought to operate as drastic cathartics. Within a certain range, however, *quantity* has a considerable influence. Another circumstance which tends to influence the operation of Cathartics is *mechanical division*. The resinous Cathartics, when coarsely powdered, cause griping and even tenesmus; while in a state of more subtile division, they operate with less sensible effect—a circumstance at variance with the law which regulates the action of most other substances. Thus, if camphor be combined with senna or colocynth, the purgative properties of these substances are augmented; but at the same time their influence on the sentient nerves is greatly diminished. By such a combination, the colocynth is rendered more soluble; but in the case of the senna, the activity of which is augmented when the camphor is added to the decoction, some other explanation must be sought for.

No satisfactory explanation of the influence of the state of division modifying the action of Cathartics has yet been

* Teidemain and Gmelin.

attempted. Were I to hazard an opinion, I should say that it depends upon some change effected in the substance, when so great a surface is exposed to the action of the air as necessarily must be the case when resinous substances are reduced to impalpable powders. Whether any thing like oxidizement occur, future experiments must decide. The opinion, however, is not improbable, when we observe the great change which even light produces upon impalpable powders. If a powder—for instance, rhubarb—be preserved in a glass bottle, the side which is always exposed to the light will be changed in colour and rendered nearly white, while that which is shaded from it remains unchanged both in colour and medicinal property. The last circumstance to be mentioned, as influencing the operation of Cathartics, is *combination*. Excitants augment the energy of purgatives, by elevating, as it were, the vitality of the torpid bowels ; the purgative substance makes a more powerful impression in the ratio of the increased susceptibility to impression of the mucous membrane. In this the cathartic action is more rapid and more forcible, while, at the same time, nausea and gripings are abated. Emollients, on the other hand, diminish the influence of Cathartics ; and the same is the effect of acidulated fluids. With respect to narcotics, under ordinary circumstances they weaken or retard the operation of purgatives ; but, in cases of spasm affecting the intestinal tube, the addition of an opiate, by allaying this, tends to augment the powers of the narcotics. Sydenham frequently combined opiates with narcotics, and found that the narcotic, by resolving spasm, aided greatly the peristaltic movement of the canal.

Cathartics differ as to the time necessary for producing their effect : some operate in a few hours, others require from eight to twelve. These differences are supposed to depend in a great degree on the solubility of the substance in the gastric juice and fluids of the alimentary canal. The time required is said to be exactly in the inverse ratio of the solubility of the purgative ; from which circumstance, the saline purgatives operate in the shortest time, and the resins, from their insolubility, require the longest time. It is probable, also, that this difference of solubility enables them to

act on different parts of the canal. If, for example, they are altered by the juices of the stomach, as in the case of calomel, which acquires activity from meeting with muriatic acid in that viscus ; or if they be very soluble in the juices of the duodenum, as in the case of jalap, they will act immediately there: their action will not, however, be confined to that part, but will be extended through the whole canal, increasing the excretion of the fluid secretions of the part.

The resinous cathartics, on the contrary, being much less soluble in the animal juices, dissolve more slowly, and therefore operate upon the lower intestines. But, in admitting the plausibility of this explanation, truth obliges us also to admit that it is not satisfactory ; as aloes, for example, if applied to an ulcerated part on the surface of the body, still exerts its purgative influence chiefly on the rectum ; and aloes is more soluble than jalap, which acts on the duodenum.

It is of importance, in a practical point of view, to be intimately acquainted with the time required for the operation of purgative medicines ; as it enables us to adopt our remedies more decidedly to certain cases than to others. Thence the saline purgatives, owing to the rapidity of their action as well as their influence in emptying the vessels of the system, are best adapted for acute diseases, and especially those of a febrile and inflammatory character ; while the resinous purgatives of an opposite character are better calculated for chronic affections.

Cathartics differ considerably in their ultimate effects upon the system. In general, they induce a subsequent costiveness, which is supposed to depend on the evacuation of the fluids of the intestines, being so considerable that some time is requisite to replace them ; but it is more probable that it is the result of that law of the constitution which determines that almost every increased action must be necessarily followed by a state of inactivity or collapse. The more general also the action of a purgative, the more likely is costiveness to follow. The saline purgatives, owing to their operation on the whole intestinal canal, often leave more sluggishness of the bowels than existed before their employment. Rhubarb has the same effect; but, on the contrary, as an exception to this

rule, castor oil, which operates on the whole length of the intestinal canal, tends to produce the opposite effect; and the same property belongs to croton oil. Those resinous Cathartics which operate on the lower intestines often leave the bowels in what is termed a more soluble state, that is, more open than before.

In the administration of Cathartics, some attention is required to the following circumstances.

1. Cathartics are generally more necessary and serviceable in warm than in cold climates, owing not only to the greater vitiation of the contents of the bowels and the augmented secretion of bile in high than in low temperatures, but to the great determination of fluids to the skin in warm climates favouring the formation of scybala. As to the influence of season, it is an old maxim that purgatives should be given in spring and autumn, or, as the term is, in the decline and fall; and it is true that more inflammatory diseases prevail at these seasons than other periods of the year; but the custom should not be followed by persons in health, as it might induce a habit which would prove hurtful.

2. The constitution of the patient must be attended to. In general, Cathartics are more required by persons of a melancholic than those of a sanguine temperament, the bowels being generally more torpid in the former than in the latter. There is, however, an exception to this rule, in women, who, although they are more commonly of the sanguine temperament, yet are more generally disposed to costiveness than men; they do not, however, bear the operation of Cathartics so well. In pregnancy and during menstruation no drastic Cathartic should be administered: for it is well known that medicines which cause abortion do so by their cathartic influence on the rectum; nor should they be freely administered in states of debility. Where any idiosyncracy exists connected with the operation of Cathartics, it should not be disregarded; as much injury may follow the employment of certain kinds of purgatives in such instances: thus, in some individuals, a dose of rhubarb will cause convulsions, closely resembling those of epilepsy; in others, the smallest dose of calomel will produce alarming syncope. The readiness with which ptyalism is

induced in some individuals by calomel is also a circumstance which requires consideration.

3. Although a costive habit should be strictly guarded against in childhood, yet we must keep in remembrance that children bear the action of Cathartics worse than adults. On account, also, of the depressing effects of saline purgatives, those of a warm nature are best adapted for aged persons; but, in attending to this general rule, we must also recollect that debility may arise from very opposite states of the system and also from very opposite causes; and by removing these the strength is increased.

4. Cathartics ought not to be too frequently taken; as, by the excitement they produce on the mouths of the hepatic and pancreatic ducts, they cause a hasty, irregular, and imperfect secretion of the bile and pancreatic juice, which is highly injurious to the digestive function.

5. As a general rule, Cathartics are inadmissible in inflammatory states of the alimentary canal which have gone on to ulceration, or where there is a great tendency to dysenteric affections.

6. The nature of a Cathartic determines the period in which it should be administered. If it require a long time to operate, it should be given at bed time; if it be of quick operation, in the morning, or at any time during the day: thus, saline purgatives, senna, castor oil, croton oil, and elaterium, are best administered in the morning; the gum resins, sulphur, and calomel, in the evening. But the action of Cathartics may be at any time quickened by copious dilution with warm aqueous fluids. When spasm is present, the Cathartic may be combined with opium or some narcotic; for although opium may retard the quick operation of the Cathartic, yet, when spasm affects the intestinal canal, this addition secures and promotes its operation.

7. During the operation of Cathartics, cold applied to the surface must be avoided, as the body at this time is more liable to be affected by it.

8. During the operation of Cathartics, it is necessary to distinguish carefully the differences in the alvine discharges which are the result of disease and those produced by the

Cathartic. Calomel always causes the evacuations to appear unnatural; and, in order to ascertain their real aspect, the use of the medicine should be suspended for a few days. During the operation of colchicum, the stools are of a bilious character; during that of saline purgatives, daily repeated, they assume a peculiar colour; and the effect of elaterium is to produce stools resembling water in which meat has been partially boiled. The nature of these appearances and their distinctions I will point out in treating of particular Cathartics.

TABLE OF CATHARTICS.

A. LAXATIVES.

* *Organic Products.*

Animal.

a.—HONEY, prepared by			
Apis *mellifica.*	4.	12.	Diptera.

Vegetable.

b.—SACCHARINE MATTERS, contained in			
Manna.—Fraxinus *ornus.*	23.	2.	Oleaceæ.
Pulpa Cassiæ. C. *fistula*	10.	1.	Leguminosæ.
c.—ACIDULOUS FRUITS, of			
Tamarindus *Indica.*	10.	1.	Leguminosæ.
Prunus *domestica*	12.	1.	Amygdaleæ.
d.—FIXED OIL, procured from			
Olea *Europœa*	2.	1.	Oleaceæ.
Amygdalus *communis*	12.	1.	Amygdaleæ.
Linum *Ussitatissimum.*	5.	5.	Lineæ.

** *Inorganic Substances.*

e.—SULPHUR.

f.—MAGNESIA (*a hydrated oxide*).

g.—SALTS.

Magnesiæ carbonas.

——— subcarbonas.

——— Acetas.

B. PURGATIVES.

* *Organic Products.*

a.—FIXED ACRID OIL, from			
Ricinus *communis.*			
b.—OLEO-RESIN, from			
Amyris *Gileadensis*	8.	1.	Amyrideæ.
Copaifera *officinalis*	10.	1.	Leguminosæ.
Pinus *Larix*	21.	6.	Coniferæ.
—— *Canadense*	—.	—.	———
—— *sylvestris*	—.	—.	———
Pistacia *Terebinthus*	22.	5.	Anacardiaceæ.
c.—RESIN, contained in			
Convolvulus *Jalapa*	8.	1.	Convolvulaceæ.
Rheum *palmatum*	9.	3.	Polygoneæ.
—— *undulatum*	—.	—.	———
—— *Australe* vel *Enodi*	—.	—.	———
Rumex *Aquaticus*	9.	3.	———
—— *Obtusifolius*	—.	—.	
d.—RESINO-EXTRACTIVE, in			
Aloes *spicata*	6.	1.	Asphodeleæ.
—— *valgaris*	—.	—.	———
e.—CATHARTINE, in leaves of			
Cassia *Senna*	10.	1.	Leguminosæ
—— *lanceolata*	10.	1.	———

** *Inorganic Substances.*

a.—METALLIC OXIDES.

Pilulæ Hydrargyri,
Hydrargyrum cum Magnesia.

b.—CHLORIDES.

Sodii Chloridum,
Hydrargyri Proto-chloridum.

c.—SALTS.

Magnesiæ Sulphas,
Sodæ Sulphas,
—— Phosphas,
—— Tartras,
—— Tartras et Potassæ,
Potassæ Bisulphas,
——— Sulphas,
——— Bitartras,
——— Tartras,
——— Acetas.

C. DRASTIC CATHARTICS.

* *Organic Products.*

a.—GUM-RESINS, procured from			
Cucumis *Colocynthis*	21.	10.	Cucurbitaceæ.
Convolvulus *Scammonia*	5.	1.	Convolvulaceæ.
Stalagmitis *Gambogioides*	23.	1.	Guttiferæ.
Rhamnus *Catharticus*	12.	1.	Rhamneæ.
Gratiola *officinale*	2.	3.	Labiatæ.
b.—OLEO-RESIN,			
Helleborus *niger*	13.	7.	Ranunculaceæ.
c.—FIX ACRID OIL, from			
Croton *Tiglium*	21.	8.	Euphorbiaceæ.
Euphorbia *lathyris*	11.	3.	————
d.—NICOTINA, from			
Nicotiana *Tabacum*	5.	1.	Solaneæ.
e—VERATRIA, from			
Veratrum *album*	23.	1.	Melanthaceæ.
Colchicum *Autumnale*	6.	3.	————
f.—ELATINA, from			
Momordica *Elaterium*	21.	10.	Cucurbitaceæ.

** *Inorganic Substances.*

Atimonii Sulphuretum precipitatum.

D. CLYSTERS.

All Purgatives.

ORGANIC VEGETABLE PRODUCTS WHICH OPERATE AS LAXATIVES.

Animal Substances.

a. HONEY. *Mel.* L. E. D.—Honey is produced by several species of bees, but most abundantly by the Apis *mellifica*, the history of which is one of great interest*. Bees collect the sweet juice or honey secreted in the nectaries of flowers, they swallow this and again excrete it; but whether it undergo any elaboration in the body of the bee, has not yet been determined. It is probable that the change, if any, cannot be very great, as both the odour and the taste of honey is influenced by the nature of the flowers from which it is selected. Thus, when bees have been placed in fields of thyme, lavender†, rosemary‡, or any of the plants belonging to the natural order *Labiatæ*, rich in volatile principles, the Honey preserves the odour of the flower, is of a high flavour, and excellent quality; on the contrary, it is very bad in the vicinity of buckwheat. The Honey of various parts of the world is consequently known by its peculiar flavour — that of Minorca differs from that of Narbonne, this from the Honey of England; and that of the southern parts of our island from the Heather Honey produced from the heath of the Scottish mountains. The finest Honey in the world is made on the Peak of Teneriffe: the bees feed on the Ratama, the white broom of the Canaries, the Spartiun *nubigenum*. In some instances it is even imbued with poisonous properties from the flowers on which the bees have fed—a fact noticed by Xenophon in his account of the retreat of the ten thousand; and it is curious, that Turnefort, when travelling in the same country, near Trebisonde, two thousand years after Xenophon, ascertained that the Greek soldiers were poisoned by the bees collecting the Honey which produced that effect from the flowers of the Rhododendron *ponticum* and Azalea *pontica*, beautiful plants which cover the mountainous district

* See the works of Huber, Dr. Bevan, and others.

† Lavender yields the Honey of Haute Provence.

‡ Rosemary supplies the White Honey of Narbonne.

of Asia Minor. Poisonous Honey is also met with in various other parts, both in Asia and in America. The Pollistes *lecheguana* make a poisonous Honey in Brazil; probably, says M. St. Hilaire, from the juice of Paullinia *Australis**. Poisonous honey is found in Maragnon and Paraquay, produced from unknown plants. The effects these poisonous honeys produce on the habit are vertigo, nausea, and delirium. The wholesomeness of Honey, indeed, depends on the plants on which the bees feed; and many persons can eat one kind of Honey with impunity, but not another: thus, the Heather Honey of Scotland agrees well with many, who suffer severely, if they even taste that of Narbonne.

Honey is either smooth and homogeneous like syrup, or it consists of brilliant, granular crystals, dispersed through a clear, uncrystallizable fluid: the colour varies from pure white to a deep brownish-yellow; its odour also varies, but under every state is somewhat aromatic, and its taste sweet, sharp, and slightly acidulous. By keeping, Honey acquires a deeper colour, and more sharpness of flavour and taste. It is completely soluble in water, but only partially in alcohol, which takes up the fluid or syrupous part, and leaves the crystallizable untouched. The quantity of crystallizable varies in different kinds of Honey, but abounds most in the best kinds. M. Guibourt alleges that it contains, also, *Mannite*, a peculiar kind of sugar, which constitutes a large part of manna; and I would add, an acrid matter, which probably is the source of its laxative property. It may be regarded as consisting of saccharine matter, or sugar and mannite; mucilage; an odorous principle; an acrid principle; and a free acid. Like most other vegetable products of a saccharine nature, nitric acid converts it into oxalic acid.

Honey is undoubtedly laxative: but it is apt to gripe and prove flatulent when given in quantity sufficient to move the intestines: and the older the Honey, the more likely these effects are to be produced. It is therefore seldom employed in this country for purgative purposes. There are also some other animal productions which possess aperient properties: such as veal broth, butter milk, asses' and goats' milk.

* Plants Remarq: de Brezil, vol. i.

Vegetable Productions.

a. SACCHARINE MATTERS.

Under this head I have placed all those laxative substances, medicinally employed, which contain a large proportion of sugar. The greater part of the sugar used in Europe is procured from the sugar cane, Arundo *saccharifera.* When well purified, it is solid and brittle, white, inodorous, sweet, and persistent in the air. It is soluble in its own weight of cold, and to any extent in hot water. According to the analysis of Dr. Prout, loaf sugar consists of 42.85 parts of carbon, and 57.15 of oxygen and hydrogen, in the proportion for forming water: or 1 prop. of carbon = 6, + 1 of water = 9, making its equivalent 15. The alkalies combine with it and form compounds, which do not taste sweet. Sulphuric acid changes it to charcoal, and nitric acid to oxalic acid. The Saccharine Matter in fruits does not readily crystallize; and a sugar resembling that of fruits is made from starch by the action of sulphuric acid.

1. Pulp of Cassia. *Cassiæ Pulpa.* L. E. D.—This is the pulp of the fruit of a tree, a native of the East Indies, and of Egypt, where it was called Chiavxambar, the name Cassia fistula being applied by the ancients to cinnamon. The tree is now named Cathartocarpus *fistula*: it is cultivated in Egypt, but found in a wild state in Hindostan, throughout the Indian Archipelago, in Cochin China, the Antilles, and in South America, where, however, the fruit differs in several respects from that of the tree of the old Continent. It belongs to the natural order Leguminosæ*. The fruit is a long, woody, dark-brown pod, nearly two feet in length, the diameter about an inch, cylindrical, with two longitudinal furrows on one side, and one on the other. It is internally divided by transverse partitions; in each of the cells will be found a smooth, oval, shining, yellowish seed, with red lines dividing it longitudinally, embedded in a soft, black pulp.

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* Woodville's Med. Bot. 3rd ed't. 160, pl. 455. London Dispensatory, art. Cassia.

The pods are permitted to remain on the tree throughout the year. Prosper Alpinus says that they are to be kept four months before they can be used. In choosing them, the heaviest pods and those which do not rattle are to be preferred.

The pulp is the only part of use as a medicine. It has a slightly sickish odour, and a sweet, mucilaginous taste; is soluble in water, and partially soluble in alcohol and ether. The watery solution yields a precipitate with subacetate of lead, marking the presence of gum; and with alcohol, denoting the existence of gelatin; and, although none of the mineral acids affect it, yet chlorine throws down a yellow-coloured precipitate, which is insoluble in ether. From an analysis of this pulp, Vauquelin says that it contains nearly one half its weight of water, rather more than one fourth part of sugar, some gluten, gelatin, gum, and extractive matter: but, according to M. Henry, its components are 12.20 of sugar, + 1.55 of gum, + 2.86 of tannin, with other matters not made out*. As a remedial substance, the Pulp of Cassia fistula is seldom employed in this country, being apt to induce nausea, griping, and flatulence; and is solely used as an ingredient in the confectio cassia and the lenitive electuary, or Confectio Sennæ. When this is taken alone, the urine becomes tinged of a brownish colour; but this is merely a separation of the colouring matter. In doses of from ʒiii to ℥i, it proves gently laxative; but, upon the whole, it is a medicine which does not deserve to be retained in the Pharmacopœias.

b. MANNA. *Succus Concretus Fraxini orni.* L. E. D.— The Fraxinus *ornus* is a native of the south of Europe, and of Mount Parnassus, and the loftiest mountains of Greece. It is a low but a handsome tree, belonging to the natural order Oleaceæ†.

Besides this species of Fraxinus, two other species, the *rotundifolia* and *excelsior*, the Tamarisk, and a species of Eucalyptus, yield Manna. It exudes from the bark of the stem and branches, upon which it concretes; but to obtain Manna

* Journ. Chim. Med. tome ii, p. 376.

† Woodville's Med. Bot. 3rd edit. pl. 200, p. 589. London Dispensatory, art. Fraxinus.

for medicinal purposes, incisions are made into the bark of the Fraxinus, on one side only in the same season. Sometimes the Manna is collected on straws and chips fastened near the incisions, by which a finer Manna is procured. In this state it is called canulated Manna, *Manna* in Canoli. The best Manna brought to this country is closely packed in chests, and is known by the name *Flake Manna.* It is in flakes, or oblong pieces, evidently moulded by the branches on which it has concreted: it is light, friable, of a white or very pale yellow colour, and in some degree diaphanous. It has a slight, peculiar odour, a sweetish taste, but leaving a bitterish impression on the tongue. The finer pieces are often crystallized in the interior.

Manna is soluble in water, without suffering any alteration, for it can be obtained unchanged by evaporating the watery solution. It is readily dissolved in boiling alcohol; and, when the solution cools, about three fourths of the quantity dissolved is deposited in a crystallized state, not unlike the appearance of sulphate of quinia. This has been named *Mannite;* and is ordered, by Proust, who named it, to be purified by pressing it between bibulous paper, and then redissolving it in boiling alcohol: it instantly melts in the mouth, is agreeably sweet, and completely free from the nauseous taste of the Manna, which adheres to the part retained in solution by the alcohol. Mannite is soluble in five parts of cold water, nearly insoluble in cold alcohol. It is not fermentable, like sugar; yet, when treated with nitric acid, it is converted into oxalic acid. According to the analysis of Saussure, it consists of 47.82 of carbon, + 6.06 of hydrogen, + 45.80 of oxygen, and 0.32 of azote. According to Dr. Prout, it consists of 38.7 of carbon, + 63.3 of oxygen and hydrogen. On evacuating the spirituous solution, it deposites more mannite, and, finally, a thick extract is obtained, which cannot be rendered perfectly dry, and contains the nauseous principle of the drug. When Manna is treated with nitric acid, it yields both oxalic and saclactic acids.

According to the experiments and analysis of Vauquelin, Manna consists of about three fourths of Mannite, a little common sugar, a yellow nauseous uncrystallizable matter,

which is its purgative principle, and a little mucilage, which gives rise to the saclactic acid when it is treated with nitric acid.

Manna was formerly in great vogue. It is a very mild laxative, adapted chiefly for children and very delicate females; but even for these it is seldom prescribed alone. It is ordered as an adjunct to solutions of neutral salts, castor oil, and senna; but is rather adapted to cover their tastes than to aid their cathartic properties. It may be given in doses of ʒi to ʒiv, in any bland solution or in milk. Upon the whole, however, it is one of those medicines which might be well spared.

d. ACIDULOUS FRUITS.

The laxative influence of these fruits seem to depend on a combination of sugar, gum, and the tartaric, citric, and malic acids.

1. TAMARINDS. *Tamarindorum Pulpa.* L. E. D.—This is the pulp of the fruit of the Tamarindus *Indica*, a beautiful tree, a native of the East and West Indies and of Egypt, belonging to the natural order Leguminosæ*. This fruit forms an article of diet in the countries where it is produced. West India Tamarinds are imported into this country, they are preserved in syrup, after being freed from the outer shell; but those sent home from the East Indies are preserved without sugar in their natural state. Unless, however, they are kept in closely covered jars, they are very apt to get musty.

Tamarinds are inodorous, and have an acid, agreeable, sweet taste. Their goodness is ascertained by their freedom from mustiness, by the seeds being hard, flat, and clean, and by the strings or fibres which embrace the pulp being entire; and a clean knife thrust into the preserve and left there for some time should not appear coated with copper when withdrawn. According to the analysis of Vauquelin, the pulp, independent of the sugar of the preserve, contains $\frac{1}{12}$ of citric acid, less than half that quantity of bitartrate of potassa, a

* Woodville's Med. Bot. 3rd edition, pl. 161, p. 448. London Dispensatory, art. Tamarindus.

small portion of free Tartaric, and a still smaller of Malic acid, in combination with sugar, gum, jelly, and fecula. These acids are precipitated in combination with lead, when acetate of lead is added to a solution of Tamarinds; on which account the infusion of Tamarinds should not be drank when acetate of lead is prescribed in hæmorrhagies.

Tamarind Pulp is a weak but an agreeable laxative. It requires to be given in substance: for, however strong the infusion or decoction may be, it produces no action on the intestinal canal. From the extent of the dose which is required to move the bowels, it is seldom given alone, but generally in conjunction with some neutral salt, or with rhubarb or infusion of senna. It is of little value as a laxative; and should be only tolerated in the Pharmacopœia, as forming an agreeable refrigerant whey, when ℥i of it is boiled in a pint of milk.

2. Prunes. *Pruni domesticæ fructus.*—The tree which yields this fruit is indigenous, and belongs to the natural order Amygdaleæ*. For aperient purposes, the parenchyma of the Prune is softened by putting it into hot water; and in this state it operates as a mild laxative. Prunes, however, are seldom or never prescribed as medicine in this country; nor is the employment of them as a domestic remedy so general as on the Continent. They enter into several formula of other purgatives; but they add little to their cathartic properties.

e. FIXED OIL.

When a large dose of Fixed Oil is taken into the stomach, it is little acted upon by the digestive powers, and passes unaltered into the intestinal canal, where it excites an increased peristaltic motion, and is at length ejected, displaying its presence in the alvine evacuations. There are three of the Fixed Oils employed as laxatives, although not very frequently in this country.

1. Oil of Olives. *Olivæ Oleum.* L. E. D.—This oil is procured by expression from the ripe fruit of the Olive, Olea *Europea*, a tree which is a native of Africa, and is most

* Woodville's Med. Bot. third edit. p. 520, pl. 187.

abundantly cultivated in Spain, the South of France, Italy, and Greece; and which belongs to the natural order Oleaceæ*. The best oil is that which is obtained by gentle pressure from the ripe drupe, previously crushed in a mill. It should be inodorous, insipid, and soft, and agreeable in the mouth; the best is that which is made in Provence.

When an ounce or more of this oil is taken into the stomach, it resists its digestive power and passes into the intestinal canal. Besides operating as a gentle aperient, it allays colic and gripings; and thence has been found useful in dysenteric affections. It is also given with advantage as an enema, in doses of from two to three ounces or more, when the large intestines are suffering under inflammation, or from abrasions. It is also useful as a vermifuge in relieving the rectum of ascarides.

2. Oil of Sweet Almonds. *Amygdalæ Oleum.* L.E.D.—This oil is procured from the kernel of the fruit of the Almond tree, Amygdalus *communis*†, by expression. It ought to be inodorous, of an agreeable taste, and totally devoid of acrimony. It is of a greenish-white colour, does not congeal at a temperature of 9° Faht. It is turbid when newly drawn, but is readily clarified either by rest or filtration. When bitter instead of sweet Almonds are pressed, if heat be not employed, the oil is perfectly free from all bitterness. One hundred parts of Almonds yield forty-six of oil. And one hundred parts of the oil consists of seventy-six of elaine and twenty-eight of stearine. As a laxative, it operates exactly in the same manner as olive oil.

3. Linseed Oil. *Lini Oleum.* L. E. D.—This oil is also obtained by expression, from the seeds of the Lint plant, Linum *Ussitatissimum*‡, one of the most valuable plants which has been naturalized to our climate. It is a native of Egypt, in those parts which are liable to the inundations of the Nile. When the oil is cold drawn, it has a greenish-white colour, and a mild, soft taste; but, when heat is em-

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* Woodville's Med. Bot. 3d edit. p. 280, pl. 98. London Dispensatory, art. Olea

† Ibid. p.507, pl. 183. London Dispensatory, art. Amygdalus.

‡ Ibid. p. 566, pl. 202.

ployed, the oil is acrid, nauseous, and in every respect disagreeable. One hundred parts of Linseed yield about twenty-two of oil.

Linseed Oil is a more certain laxative than either Olive or Almond oil. A table-spoonful of it, taken at short intervals, gently purges; but if it be mixed with syrup, it ceases to operate as a laxative. It has been administered with advantage in inflammatory and spasmodic affections of the bowels. It has also been found useful in nephritic complaints.

* *Inorganic Substances.*

a.—SULPHUR. *Sulphur.* L. E. D.—The nature of this simple combustible has been already explained. The Roll Sulphur of both England and Sicily contains several impurities; it is therefore sublimed, and rises in vapour before it is completely fused. In this way it is prepared on a great scale, by conducting the vapour of the melting sulphur into close chambers, where it is deposited in the form of fine powder; and on a small scale, by being melted in an earthen cucurbit, and the vapour collected in a series of glass vessels, named aludels.

Sublimed Sulphur is in the form of a very bright-yellow powder, which requires to be washed with boiling water to free it from a minute portion of sulphuric acid acquired from the process. In this state it is termed washed Sulphur, *Sulphur lotum.* It is obtained in another form, also, for medicinal use—by precipitation from any liquid holding it in solution; for example, by the decomposition of a sulphuretted hydrosulphuret of lime, prepared according to the formula of the London Pharmacopœia, by boiling together one part of Sulphur, two parts of quick lime, and thirty-two parts of water. When muriatic acid is added to this compound, the Sulphur, retaining a little hydrogen and water, is precipitated, and sulphuretted hydrogen evolved. Sulphur, in the same state, is procured by receiving the vapours of common Sulphur into a vessel filled with steam or watery vapour. In this state, it is much whiter than flowers of Sulphur, and is called precipitated Sulphur or Lac Sulphuris. It is evi-

dently a combination of water and Sulphur, or a *Hydrate of Sulphur*.

When heated to 218° of Faht. the Sulphur melts and becomes as fluid as water, and vapours are driven off. If allowed to cool after being melted, and, as soon as the surface begins to congeal, the fluid Sulphur be poured out, the under part of the cake will be found crystallized in needle-shaped crystals of an octahedral figure. When heated to 220°, Sulphur fuses; and if the heat be increased to 320°, it becomes thick and viscid; and if then poured into water, it assumes a red colour and a ductility like wax, and its specific gravity is increased to 2.325. When heated in the air to 300, Sulphur inflames and is acidified.

Alcohol, ether, and fat oils, dissolve a small portion of Sulphur.

Sulphur combines with oxygen, chlorine, iodine, hydrogen, and phosphorus; and forms various compounds, some of which are medicinal agents, and shall be examined in their proper place. Sulphur is sometimes contaminated with sulphuret of arsenic. This may be ascertained by boiling gr. 50 of the Sulphur in f℥ii of oil of turpentine, pouring off the solution whilst it is hot and leaving it to deposite the Sulphur; and again boiling up the residue with the cold oil. By repeating this operation, as long as the oil dissolves any, the weight of the insoluble residue gives the amount of the impurity.

Such are the chemical properties of Sulphur; and it is of importance that the medical practitioner should know them, in order to understand some of the effects of this medicine upon the body. As a laxative, its operation is gentle; and it is the very best laxative that can be administered in hæmorrhoids, as, without exciting purging, it produces a soft, easily moulded evacuation, which does not irritate by its physical pressure upon the highly sensitive piles. In this case, it is usually combined with magnesia; and, in other cases, to quicken its operation, with bitartrate of potassa. In habitual dyspnœa, in which it is of great importance to keep the bowels soluble, it is admirably adapted to fulfil every indication desired. In these cases, the precipitated Sulphur is the best form of the remedy. In doses of ʒi combined with

gr. x or gr. xv of magnesia, it acts gently upon the bowels, and may be continued daily until it manifest its odour on the skin, when its employment may be intermitted for a few days.

b. MAGNESIA. L. E. D.—This oxide is found native in the state of a hydrate; in which condition it is of a snow-white colour, passing into greenish-white, having a foliated fracture. It is soft; adheres to the tongue; and is soluble in acids. In this state the mineral contains about 70 per cent. of Magnesia and 30 of water. In steatite, another magnesian fossil, the proportions of Magnesia is 30 per cent. Magnesia for the purposes of medicine is prepared from the subcarbonate of Magnesia.

When subcarbonate of Magnesia is submitted to the action of a red heat, the carbonic acid is driven off, and the simple oxide, or *Calcined Magnesia*, as it is termed, remains; but if too much heat be employed, the Magnesia partially vitrifies and runs into masses. In this process, the carbonic acid combines with caloric and flies off in the form of carbonic acid gas. The carbonate loses about 60 per cent. of its weight, of which from 15 to 20 per cent. are water and the remainder carbonic acid gas. In well-prepared pure Magnesia the components are 1 prop. of Magnesium = 12.7, + 1 prop. of oxygen = 8, making the equivalent = 20.7; or of Magnesia 60, and oxygen 40 parts, in 100. This oxide, or Magnesia, is a pure, white, inodorous, insipid powder. It is nearly insoluble in water, requiring 51.42 of water at 60° for its solution. It does not extricate heat when it is mixed with that fluid. It is reconverted into the carbonate when it is exposed to the action of the atmospherical air, owing to its powerful affinity for carbonic acid, which is always floating in the atmosphere.

It is sometimes adulterated with lime; but the fraud is easily detected by dissolving the suspected magnesia in diluted sulphuric acid. The insoluble residue is the sulphate of lime.

c. SUBCARBONATE OF MAGNESIA. *Magnesiæ Subcarbonas*. L. E. D.—This substance, which was formerly known by the name of Magnesia alba, was prepared by precipitating the mother lee of nitre. It was invented by an

Italian priest in the beginning of the eighteenth century; and was sold at Rome as a nostrum for the cure of all diseases. A few years afterwards, Valentini informed the public that it might be prepared by calcining the lixivium, or *mother*, which remains after the preparation of nitre. Slevoyt then discovered that it might be prepared by precipitating this lee with potassa; but the real nature of the preparation was not known until Dr. Black published his masterly dissertation on the subject in 1753. It may be readily prepared by precipitating the sulphate of Magnesia with subcarbonate of potassa, washing the precipitate and drying it. In this process a double decomposition takes place. The sulphuric acid leaves the magnesia and unites to the potassa of the subcarbonate, whilst the carbonic acid combines with the magnesia of the sulphate. The carbonate of magnesia is insoluble and is precipitated; the large quantity of water employed holds the sulphate of potassa in solution. Carbonate of soda is preferable to carbonate of potassa, because the sulphate of soda formed is more soluble than the sulphate of potassa, and consequently more easily washed out of the precipitate. But the greater part of the Carbonate of Magnesia found in the shops is prepared by precipitation from *bittern*, the lixivium which remains after the crystallization of common salt, and which is a muriate of Magnesia, or, in more correct language, a chloride of Magnesium. The bittern is heated to 212°, and the impure carbonate of potassa added to it; after which the fire is withdrawn. In this process the muriatic acid leaves the magnesia, or rather the chlorine leaves the Magnesium, and, becoming muriatic acid, by the partial decomposition of the water and attracting its hydrogen, attaches itself to the potassa, forming a muriate of potassa, which is soluble, and therefore retained in the water of the process, whilst the carbonic acid unites to the Magnesia which is set free, and forms an insoluble subcarbonate, or rather carbonate of Magnesia, which is precipitated. This precipitate is then extremely well washed, and brought to market in the form of square masses. Thus prepared, the Subcarbonate of Magnesia is a pure white or colourless, light, elastic powder, inodorous, and nearly insipid, insoluble

in water, but converting the vegetable reds to blue and green. Heat does not melt it; but it becomes luminous when exposed to a very strong heat.

It is a hydrated subcarbonate, composed of 47.6 parts of Magnesia and 52.4 of carbonic acid in 100; or, according to Berzelius, of 36.263 of carbonic acid, 43.956 of Magnesia, and 19.781 of water; or of 1 prop. of Magnesia = 20.7 and 1 prop. of carbonic acid = 22, making the equivalent = 42.7.

If it be not well washed, it will contain sulphate of Magnesia, which may be detected by dissolving the Magnesia in nitric acid and adding nitrate of baryta; if the sulphate be present, an insoluble sulphate of baryta will be formed; but if the adulteration be lime, subcarbonate of ammonia will throw down a precipitate in the nitric solution.

This preparation, although termed a subcarbonate in the Pharmacopœias, is a carbonate. It is converted into a *bicarbonate*, which is crystallizable, by diffusing it in water and passing carbonic acid through the mixture; or, what is more convenient, by mixing together a solution of 125 parts of Magnesia and 136 of carbonate of soda, filtering and leaving the solution to spontaneous evaporation. The salt thus prepared is in the form of hexagonal prisms, nearly tasteless, dissolving more abundantly in cold than in hot water, owing to the latter expelling a portion of the carbonic acid, and reducing the salt to the state of the carbonate.

d. ACETATE OF MAGNESIA. *Magnesiæ Acetas.*—This salt, which has not a place in the Pharmacopœias, may be formed by dissolving Magnesia in acetic acid. It does not crystallize, but forms a viscid mass. It has a sweetish taste, with a slight degree of bitterness: it is deliquescent, and is very soluble in water and alcohol. It consists of 65.96 of acetic acid and 34.04 of Magnesia in 100 parts.

e. CITRATE OF MAGNESIA. *Magnesiæ Citras.*—This salt is also readily prepared by combining its constituents, Magnesia and citric acid. The citrate does not crystallize, though it be evaporated to the consistence of a syrup; but it forms a white, spongy, opaque mass, which rises in the vessel like a mushroom. Both the acetate and the citrate may be

formed as extemporaneous preparations by combining their constituents at the moment of administering them.

All the preparations of Magnesia are simply laxatives: they operate mildly, and yet with sufficient energy, when they meet with acid enough to convert them into muriates and acetates. When the acidity of the stomach is so small that the Magnesia alone is present in the stomach, it does not operate even as a laxative; and in this case lemon juice or vinegar and water should be drank immediately after swallowing the Magnesia, which is thus rendered active. As a laxative, the pure Magnesia is preferable to the carbonate, the extrication of the carbonic acid in the stomach rendering the administration of the carbonate very inconvenient. Like many other alkaline substances, Magnesia allays the irritability of the stomach and checks nausea; I have seen a dessert spoonful of Magnesia in a glass of sherry wine allay very distressing vomiting.

When Magnesia does not act freely as a laxative, and has been taken for some time, it is apt to form into concretions. Those persons, therefore, who take it in small doses with the view of obviating a tendency to the formation of urinary calculi, should frequently clear out the intestinal canal with a brisk purgative.

The magnesian preparations are well adapted for infants and children, as the prevailing acescency of the stomach and intestines insures their operation, and the irritability always attendant on dentition is greatly allayed by the Magnesia operating on the sentient nerves of the stomach. The dose of the carbonate, to an adult, is from ℈i to ʒi; that of the pure oxide from gr. xv to ℈ii. The best vehicle for taking it is milk.

B. PURGATIVES.

This division of Cathartics contains no animal purgative that I am aware of; and those which are vegetable products, although they may be, in some degree, digestible substances, yet are not dietetical.

* ORGANIC PRODUCTS WHICH OPERATE AS PURGATIVES.

a. FIXED ACRID OIL.

This consists of fixed oil holding in solution an acrid principle, which is the real purgative agent.

1. Castor Oil. *Ricini Communis Oleum.* L. E. D.—The Ricinus *communis*, or Palma Christi, which yields this oil, is a plant generally diffused over most of the countries within the tropics; and which has been cultivated as an ornamental plant in this island since the year 1562. From its being a native of Greece, the plant was well known to the ancients, who named it *kiki* and *kroton*, from the resemblance of its seeds to the insect termed Tick, which is frequently found upon the ears of dogs; and its present name, Ricinus, is derived from the same source. It is an annual plant, belonging to the natural order *Euphorbiaceæ**, of quick growth, sometimes, in favourable situations, rising to the height of sixteen feet; but never, as some have asserted, becoming woody.

The seeds of this species of Ricinus abounds with oil; but that contained in different parts of the seed possesses different properties. It is unnecessary to enumerate the opposite statements on this subject, which have been made by different authors, from the time of Serapion to the present period. M. Guibourt has finally decided the question. He has found that the testa or husk of the seed contains no acrid principle, and merely gives colour to the oil when this is expressed; that the embryon, or germ, although in taste it seems to possess more acrimony than the perisperm, yet, is not the sole seat of the acrid principle; that the perisperm, or cotyledons, contains both the acrid and the oily principle; and that the acrid principle is volatile and may be dissipated by boiling the oil in water.

The oil is extracted from the seeds both by the aid of caloric and also by simple pressure. The first method has

* Woodville's Med. Bot. 3rd edit. pl. 221, p. 624. London Dispensatory, art. Ricinus.

been employed since the time of Dioscorides, and with little alteration. The bruised seeds are put into a bag, and suspended in boiling water, until the oil is extracted and rises to the surface, when it is skimmed off. In some instances the seeds are decorticated, then beaten into a paste, which is boiled in four or five times its weight of water, and the oil is skimmed off as it rises to the surface. It is then heated in another vessel until the water is driven off, and passed through a strainer. In the southern provinces of India the seeds are soaked, for several days, before they are bruised. When the boiling is too long continued, the acrid principle is dissipated; if the heat be too great, the oil becomes extremely acrimonious and high coloured. The great difficulty, therefore, of always determining the exact point of temperature was the chief cause for the introduction of the press, for obtaining the oil from the seeds of Ricinus *communis*. Another disadvantage of the oil obtained by coction is the tendency which it has to become rancid; the greater part of the oil now used, therefore, is procured by pressure*. The finest oil is prepared by decorticating the seeds, reducing them to a paste, either in the mortar or by grinding in a mill, and submitting this paste to the press without heat. But the expensive and tedious nature of this process prevents it from being frequently employed; and in general the seeds are ground without decortication, and pressed between hot iron plates. The oil is then clarified by rest, and filtered when cold.

In whatever manner obtained, good Castor Oil is thicker and heavier than the fat oils, and more transparent, of a greenish-yellow or amber colour; sometimes it is reddish, when much heat has been employed in pressing the seeds. It has no odour, and at first only a slightly mawkish, sweet taste, which is succeeded by a sensation of acrimony, or an arriere gout, as the French term it. When exposed to the air, it becomes thicker than before, without losing its transparency; yet it does not congeal at many degrees below zero.

* This method of procuring the oil was first employed in the West Indies about sixty years ago.

In its chemical properties, Castor Oil seems to hold an intermediate space between the volatile and the fixed oils. Like the former, it is entirely soluble in twice its weight of strong alcohol—a circumstance which affords an excellent test of its purity ; for, if it contain any admixture of fat oil, the solution is imperfect and milky. Indeed, Castor Oil may be procured from the bruised seeds digested in alcohol, and the spirit afterwards separated by distillation. The oil thus obtained is more active than that procured by expression ; but it has this disadvantage, it becomes sooner rancid. In this process the whole of the acrid matter is taken up by the alcohol ; whilst only a portion of it is mixed with the bland oil when Castor Oil is procured by coction with water or by expression *. Sulphuric ether also dissolves Castor Oil in any proportion †.

Castor Oil resembles fat fixed oil in its unctuosity, in not boiling at a temperature under 600°, in forming soaps with the mineral alkalies, and in attracting oxygen, and becoming more viscid when exposed to the air. Like them, also, it is converted into a substance something like resin when acted on by diluted nitric acid; it forms glycerine when treated with oxide of lead, and becomes rancid by keeping.

When distilled, per se, Castor Oil gives over three distinct substances, besides a considerable quantity of inflammable gas, which burns with a blue flame, resembling that of carbonic-oxide gas. The first product which swims uppermost in the receiver is of a deep straw colour, has a most penetrating, pungent odour, and a hot acrid taste, evidently acid ; the second resembles margaric acid, in being crystallized, melting at 134°, and again crystallizing on cooling, and dissolving in alcohol, but not in water ; the third, which is heavier than the other two, is as colourless as water, acid to the taste, with an oleaginous odour, and some of the pungency of the first product : what remains in the retort is black, thick,

* This property of Castor Oil to dissolve in alcohol has led to its abuse in the adulteration of essential oils, particularly oil of cloves ; as it cannot be detected by dissolving the oil in alcohol.

† This solution in ether has been found to be a useful local application in rheumatic pains of the joints.

tenacious, and evidently containing much carbon. As these products are certainly the results of a decomposition and recombination of ultimate constituents, this method of treating Castor Oil does not throw any light on the nature of its acrid and purgative principle. When Castor Oil, as I have already said, is boiled in water, it loses its activity, and may be eaten as salad oil; from which it is evident that the active principle is volatile.

The ancients employed Castor Oil chiefly as an external application; and it is still used in India in ring worm, porrigo, and many other cutaneous diseases. The active principle is not confined to the fruit; for the bark, both of the root and the stem, purges powerfully; and, when made into balls in conjunction with chillies and tobacco leaves, we are informed by Dr. Ainslie, in his work on the Materia Medica of Hindostan, is an excellent remedy for gripes in horses.

The greater part of the Castor Oil now employed is imported from India, where it is prepared by expression without heat. It is brought over in casks and skin bottles, or duppers. It is paler coloured, less nauseous, and less active than the West India oil, which is generally prepared by coction with water. Scarcely any West India oil is now brought to market; instead of which, much of the East India oil is exported to the West India islands; except to Jamaica, whence it is still an article of export. A small quantity of Castor Oil is prepared in this country; and a formula for its preparation is given in the Pharmacopœia of the London College; but it is seldom employed. One pound of the entire seeds expressed, without heat, yields about f℥v of a light, citron-coloured oil; but if heat be used, the same quantity of the seeds yields f℥vii. A pound of the seeds, decorticated, yields from f℥viiss to f℥viii of colourless oil. By alcohol a larger proportion is obtained.

As a Cathartic, Castor Oil operates quickly, with little irritation, and effectually clears out the bowels. The seeds, which were more frequently employed by the ancients than the oil, are more drastic in their operation, and are, therefore, now scarcely ever employed. This difference between the seeds and the oil depends on the acrid principle being

separate from the bland oil in the cotyledons of the seed, and adhering more tenaciously to the farinaceous part of the seed than the bland oil. The acrid principle is dissolved in the bland oil by the process of expression; but a large portion of it is left in the marc, which is an active Cathartic after all the oil is expressed from it. From its quick and mild operation, Castor Oil is peculiarly adapted for children, puerperal women, and all cases in which the evacuations of the intestines are required with little constitutional disturbance. Experience has ascertained that it is the best purgative that can be employed in that affection of the bowels which is caused by swallowing carbonate of lead, and which is known by the names of colica pictonum, or painter's colic, the Devonshire colic, and the dry belly-ache; and it is the more useful in that disease, as it may be joined with opium and other narcotics without having its purgative properties lessened. For the same reason, Castor Oil is advantageously given in calculous affections. It has been, also, regarded by some Continental physicians, particularly Drs. Odier and Dumont of Geneva, as peculiarly well suited for expelling the tape worm, Tenia *lata*. Exhibited per anum, in large quantity, I have found it very useful against the small thread worms, ascarides, which often infest the rectum. No purgative with which I am acquainted can be so much relied upon for combating habitual costiveness as Castor Oil, when properly administered. For this purpose, a large dose must first be given in the morning, and the use of the oil continued for some weeks; gradually diminishing the dose daily, until half a teaspoonful only is taken: on the discontinuance of which, the bowels continue to be relieved without further artificial assistance.

One disadvantage attending the use of Castor Oil, is its tendency to excite vomiting; but this is counteracted by combining it with some aromatic. The best modes of exhibiting it, in general, has been much canvassed: it is given floated on water, with a small portion of brandy poured over it; and, when this can be swallowed at once, there is no better mode: but as this cannot always be done, it has been given in warm milk, in coffee, and in ale, according to the

taste of the patient, as all these vehicles cover the flavour. Where there is much objection to the taste, it may be conveniently formed into an emulsion with mucilage of gum, or the yolk of egg, and cinnamon or peppermint water. The dose for an adult, to produce its full effect, is from fʒiv to f℥iss; but, as I have already stated, Castor Oil has such a tendency to leave the bowels relaxed, that a few drops is sometimes an adequate dose for those who have long taken the medicine. When the oil cannot be retained on the stomach, it has been proposed to administer an emulsion of the decorticated seeds, when these can be procured free from rancidity. The seeds are first reduced to a pulp or paste, and water gradually added as long as any milky fluid is produced. This purges briskly, without much inconvenience: but an aromatic added to the oil is generally sufficient to enable it to agree with the stomach. Upon the whole, Castor Oil is a purgative of great value, and one which, as it is in daily use, should be well understood.

b. OLEO-RESINS.

These consist of *volatile oil* in that state of combination with resin which is found in those semifluid substances known by the names of *Balsams* and *Turpentines*. The former appellation, however, is improperly given to substances of this description, unless they naturally contain benzoic acid, which is not the case with either the *Balsam of Copaiba* or the *Balm of Gilead*, both of which are true turpentines; and, therefore, I have classed them under Oleo-Resins. All these substances agree in certain qualities, but differ in the nature of the essential oil which they contain; thence it is requisite to take a brief review of each of them.

1. BALSAM of GILEAD. *Amyris Gileadensis Resina.* E.— This turpentine is produced by a species of Amyris, the *Gileadensis*, an evergreen, which grows in Ethiopia and Arabia, belonging to the natural order Amyrideæ*. It is procured from incisions in the trunks and branches of the

† Woodville's Med. Bot. 3rd edition, p. 603, pl. 214. London Dispensatory, art. Amyris.

tree, and also by the decoction of the young branches and the leaves in water. When obtained by incisions, this turpentine has the consistence of syrup; is whitish, opaline when recent, and becomes yellow and more consistent by age. Its odour is not unlike that of Chian turpentine; its taste is aromatic, bitter, and acrid. When procured by decoction, which is sometimes the case, it is liquid, yellowish, turbid, acquiring a considerable degree of solidity; its odour is strong and agreeable, but much less than that of the Balsam procured by incisions into the trunk of the tree.

Vauquelin has published an account of some experiments he made on this turpentine: he found that it differed from the others, in leaving, after the action of alcohol, a small residue, which swells and becomes gelatinous in the alcohol.

This turpentine was greatly prized by the ancients, who gave it different names, such as opobalsamum, carpobalsamum, and xylobalsamum, according as it was procured from the trunk and branches, the fruit, or from both, by decoction.

The real Mecca Balsam, or Balsam of Gilead, scarcely ever finds its way to this country, or indeed to Europe: and it is of little consequence, as, notwithstanding the eulogies of the ancients and the blind confidence reposed in its efficacy by the modern Asiatics, it certainly possesses no advantage over the other turpentines; and its expulsion from the Edinburgh Pharmacopœia would be creditable to the learned body under whose directions that work is compiled.

2. Balsam of Copaibæ. *Copaiba.* L. E. D. — This Oleo-Resin is obtained from boring the stem of the Copaifera *officinalis*, and some other species of the same genns of plants. Indeed, all the species, which are pretty numerous, yield Copaiba; and the greater quantity of that which is bronght to this country is yielded by the Copaifera *Multijuga*, in the province of Para. M. Hayne thinks this is the species referred to by Piso and Marcgrav, who first mentioned Copaiba in 1648. The Copaiba brought to this conntry under the name of Brasilian, is the product of another species, the C. *Jacquinii.* The C. *officinalis* is a handsome, lofty tree, a native of South America, but particularly abounding in the

Republic of Venezuela. It has been naturalized in Jamaica, and some other of the West India islands. It belongs to the natural order Leguminosæ.*

The trunk of the tree is bored about two feet from the ground, and this operation is generally performed about three times in the season: each time the boring produces about ten or twelve pounds of the Oleo-Resin or Balsam, as it is termed, or each tree affords about thirty-six pounds in the year. The juice is received into calabashes. It is, at first, very fluid and colourless, but soon thickens and assumes a straw-yellow hue. At an after period, when long exposed to the action of the air, like the essential oils, it attracts oxygen from the atmosphere, thickens, dries, and gradually changes into a solid, brittle, dry resin. As we receive it, the Balsam of Copaiba has the consistence of olive oil, is clear, transparent, of a pale straw-colour, and having a specific gravity less than water, or 0.950. It has a strong, peculiar, but not disagreeable odour; and a bitter, acrid, nauseous taste. It is soluble in alcohol, but remains for some time milky, on account of some insoluble matter which is joined with it, and which the French chemists regard as Animè: it is also soluble in ether, but completely insoluble in water.

When Copaiba Balsam is distilled with water, an essential oil rises, and passes over, nearly equal in quantity to one-third, sometimes to half the balsam employed. It is a light, volatile oil, of a greenish colour and a penetrating odour: the resin which remains after all the oil has passed over, is transparent, of a greenish-brown colour, affording a smooth fracture, but has scarcely any odour or taste; and what there is depends on its retaining, still, a small portion of the volatile oil. The oil procured is limpid, has the taste and the smell of Copaiba, but in a more powerful degree. This oil is much less soluble in alcohol than Copaiba itself, requiring eight parts of alcohol for its solution, whilst the Copaiba requires scarcely six: in other respects it has all the properties of volatile oil. It is said to assume a blue colour when the distillation has been made on an alkali. Although the oil

* Woodville's Med. Bot. 3rd edit. p. 609, pl. 216. London Dispensatory, art. Copaifera.

passes over at a heat inferior to that of boiling water; yet Schomberg, a German chemist, asserts that the Copaiba is decomposed in this process, and that both the oil and the resin are new products. This opinion, however, is erroneous; Copaiba, like all the turpentines, is a compound of volatile oil and resin. No benzoic acid is procured, even when the Copaiba is submitted to destructive distillation—a sufficient proof that it is improperly named Balsam.

Copaiba is scarcely affected by hydrochloric and acetic acids. Sulphuric acid, in the proportion of one part to three parts of the Copaiba, forms with it a reddish plastic mass; and this effect affords the means of detecting its admixture with castor oil, which is merely thickened by admixture with this acid: the redder, therefore, and more plastic the compound, the more free is the Copaiba from castor oil. When mixed with a larger proportion of the sulphuric acid, Copaiba is decomposed; evolves a strong odour of sulphur; and yields artificial tannin. When four parts of nitric acid and one of Copaiba are mixed, and heat applied, the acid is decomposed, nitrous fumes are evolved, accompanied often with flame, and artificial tannin is produced. When united with the pure alkalies, saponaceous compounds are formed, which produce milky emulsions when mixed with pure water. Two parts of Balsam and one part of solution of soda, or soap-boilers' lee, form a solid soap; but it attracts moisture from the atmosphere when kept.

According to the analysis of Stoltze, Copaiba contains of volatile oil, procured by distillation, 38.00, + adhesive brown resin 1.66, + brittle yellow resin 52.00, + brittle resin with traces of extractive 0.75, + volatile oil left in water and loss 7.59, in 100 parts.

The action of reagents enables us to ascertain the purity of Copaiba. The simplest mode is to boil any given quantity of the Balsam in water to dryness: if the Copaiba be pure, a hard, brittle resin will remain; thence the consistency of this residue determines the purity of the specimen. Another simple method is to mix two parts of Copaiba with one part of an alkaline solution, consisting of three-fourths of carbonate of potassa and one of pure potassa: if the Copaiba be

pure, after some hours the mixture divides into two parts: but if the Balsam is adulterated with one-eighth of castor oil, the whole will remain as a gelatinous mass. If four parts of Copaiba and one of carbonate of Magnesia be rubbed together and left at rest, it will assume an appearance not unlike solution of gum acacia, if the Copaiba be pure; but it will be opapue, if the Copaiba be adulterated with oil. There are other tests; but these are sufficient to determine the purity of this substance.

Copaiba is either a simple stimulant or a purgative, in proportion to the extent of the dose. In doses of ʒi, rubbed into an emulsion with mucilage of gum, it operates kindly on the intestinal canal and affords great relief in hæmorrhoidal affections; both evacuating the contents of the rectum and allaying the irritability of the inflamed surface, by lessening the determination of blood to the part. This effect may probably be in part owing to the determination which it induces to the kidneys, therefore operating as a counter-irritant. There are various methods of administering the remedy: among others, by spreading a pound of Copaiba on a dish and sprinkling over it an ounce of calcined magnesia, then mixing it intimately, and exposing the mixture to the air for fifteen or twenty days, it acquires a consistence fit for making pills, which possess the same efficacy as the pure Copaiba. The essential oil procured by distillation has the same properties as the Copaiba; but the resin is inert.

When the Copaiba or the oil is moderately overdosed, it sets up fever in the system, accompanied with headache, thirst, great heat in the bowels, and a sensation of burning in the urethra while passing the urine; and the kidneys are so much stimulated that bloody urine is secreted. But, like some other oleo-resins, these symptoms do not occur when the dose is so large as to operate at once upon the bowels. A French officer at Valladolid, in 1808, took two ounces of Copaiba for a dose; it operated as a drastic Cathartic, and cured a gonorrhœa, under which he was labouring, without causing much inconvenience*.

3. TURPENTINES.—*Terebinthina Veneta; T. Canaden-*

* Revue Medicale, tome ix, p. 10.

sis; T. Vulgaris; T. Chia. L. E. D.—These Turpentines, and others closely resembling them, are, with the exception of the Chian Turpentine, productions of the Pinus family of plants, a genus belonging to the natural order Coniferæ.

a. Pinus *Larix*, the Larch*, which yields the Venice or Briançon Turpentine, is a native of the European Alps, and now naturalized to this country. The Turpentine is deposited near the centre of the tree in minute reservoirs.

b. Abies *Canadensis*, vel Pinus *Canadensis*, the Hemlock Spruce, which furnishes the Canada Balsam, is a native of North America.

c. Pinus *Sylvestris*, the Scotch Fir, which yields common Turpentine, is a native of the North of Europe†.

d. Pistacia *Terebinthus*, which secretes the Chian Turpentine, is a native of Barbary and the South of Europe‡, belonging to the natural order Anacardiaceæ.

All the Turpentines yielded by these trees are nearly the same in their chemical as well as their medicinal properties. Some of them exude spontaneously; all of them are procured by making notches in the trunks of the trees, from which they flow; and all of them are afterwards inspissated by exposure to the air. The Chian Turpentine is the most esteemed of all the Turpentines, on account of its agreeable odour, and its taste, which is neither bitter nor acrid. All of them are semifluid, tenacious, semitranslucent, and exhale an agreeable odour. The common Turpentines have a warm, pungent, bitterish taste; they are inflammable; soluble in fixed oils, alcohol, and ether, affording, when distilled with water, volatile oil in combination with a small proportion of succinic acid, and a brittle resin.

These Turpentines, although the volatile oil which they yield is frequently administered by the mouth, yet are seldom given as remedies, except in the form of clysters, in which they have been found extremely serviceable in languid or torpid conditions of the intestinal canal, and in the sinking state

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* Woodville's Med. Bot. 3rd edition, p. 7, pl. 4.

† Ibid. p. 1. pl. 1. London Dispensatory, art. Pinus.

‡ Woodville's Med. Bot. third edit. p. 29, pl. 12. London Dispensatory, art. Pistacia.

of some febrile affections, especially erysipelas of a malignant nature. They may be exhibited in doses of from ʒi to ℥ss, rubbed up with yolk of egg, or mucilage and sugar, and water, into emulsions. If administered by the mouth, the dose should not exceed ʒss, which may be made into pills with any bland powder, such as that of liquorice root; but, when given as Turpentines, the dose is more likely to operate on the kidneys than upon the bowels. In some peculiar states of the habit, and some idiosyncracies, the Turpentines are apt to cause an eruption on the skin closely resembling eczema, and, consequently, their use should be discontinued.

c. RESIN.

When turpentine and some other similar products of plants are distilled, volatile oil passes over into the receiver, and a brittle, semitransparent, inodorous body, of a greater specific gravity than water, and insoluble in that fluid, remains in the retort. This is *Resin.*

Resin can never be completely freed from other substances so as to be insipid; but its sapidity or taste depends on some distinct principle. Resin is soluble in alcohol, ether, the fixed oils, the volatile oils, and the alkalies. Sulphuric acid dissolves it, and converts it first into artificial tannin and then into charcoal: nitric acid acts upon it slowly, and dissolves it; and this solution, when evaporated, yields a viscid matter, which, on the abstraction of the acid by water, gradually assumes the character of artificial tannin: muriatic acid dissolves it slowly, without changing its properties; and the same is the effect of the action of acetic acid. From these facts, it is evident that resin has much affinity to the volatile oils; and as these oils, when long exposed to the atmosphere, are converted into resin, whilst a portion of water is also formed, it is probable that the only distinction between Resin and volatile oil is that which results from the difference in the quantity of the ultimate components. According to the analysis of Gay Lussac, Thenard, and Dr. Ure, pure Resin consists of—

	Gay Lussac, Thenard.	Ure.
Oxygen	13.337	12.50
Carbon	75.944	75.00
Hydrogen	10.719	12.50
	100.000	100.00

From this account of Resin, it is evident that, as it is insoluble in water, it is not like to be very soluble in the salivary, gastric, and other animal secreted juices; and, consequently, that it can possess little medicinal power when taken into the stomach in its pure state: but Resin, modified by other agents, becomes very active, whether the other substances be combined with it by the hand of Nature, or in the laboratory of the chemist. Thus, Resin, combined with volatile oil, as a proper juice of some plants, forms the turpentines. If we unite Resin artificially with an alkali, the saponaceous compound which results is stimulant when taken into the stomach, operating upon the nerves of the intestines and increasing their peristaltic movement; while, in larger doses, it excites nausea and vomiting; thereby undeniably demonstrating its influence on the animal economy. It is the natural combination of the Resin with other substances, producing a medicine possessed of purgative qualities, that we have now to examine.

1. JALAP. *Jalapæ Radix.* L. E. D.—A natural production, in which resin is combined with extractive and fecula. Jalap is the tuberous root of a plant which has always, until lately, been regarded as a species of Convolvulus, which receives its specific name *Jalapa*, for Xalappa, a city of Mexico, from the neighbourhood of which it was originally brought, in 1610. It was at one time supposed by Linnæus to be the root of the Marvel of Peru, Mirabilis *Jalapa;* and then of a species of Convolvulus, the C. *Panduratus* or *Mechoacan:* both opinions have turned out to be erroneous. Jalap is sometimes mixed with these roots, and also the roots of bryony, sliced; but the deception is easily detected: the roots of bryony are whiter and less compact than those of Jalap, and do not burn at the flame of a candle like the latter. The root of Jalap is tuberous, egg-shaped, and, as imported into

Europe, covered with a dark-coloured wrinkled bark. The plant belongs to the natural order Convolvulaceæ. This plant, which yields the true Jalap of commerce, is, with much probability, supposed to be an Ipomœa, and this is stated to be the fact by Dr. John Redman Coxe*, who obtained the plant from Mexico and cultivated it†.

A plant under the name Ipomœa *Macorrhiza* was sent from Charles Town by Michaux, in 1803, and lived for two years in the Jardin des Plantes at Paris: it weighed, on its arrival in France, 47¾lbs. Now, I have never seen any of the roots of Jalap sent to this country exceed two pounds in weight.

The roots of the Convolvulus or Ipomœa *Jalapa*, as they are found in commerce, are tubers of about two or three inches in diameter, cut longitudinally, or sometimes entire, and merely notched, seldom exceeding a few ounces in weight. Sound Jalap in this state is heavy, compact, hard, breaks with a resinous fracture, and exhibits circular, resinous veins or layers. The odour is heavy, and the taste sweetish and slightly pungent. Both water and alcohol extract, separately, a part of the active principle of Jalap; but neither the alcoholic nor the watery infusion act in so perfect a manner as a tincture with diluted or proof spirit, which is the proper menstruum of Jalap. When pure alcohol is employed, and the solution is boiled in animal charcoal, a resin nearly devoid of colour is obtained. This resin is soluble in oil of turpentine, ether, acetic acid, and the fixed alkalies, as if it were simple resin; yet it contains a powerful Cathartic principle, as it purges in doses of from six to ten grains.

When the resin of Jalap is acted on by ether, one third only is dissolved; and this, when the ether is evaporated, is soft to the touch, leaves a greasy stain on paper, and has the consistence of a plaster; the two thirds that remain undis-

* See American Dispensatory, 8th edit. vol. v, pl. 1, 2. London Dispensatory, art. Jalapa. Annales du Museum, Hist. Nat. t. ii, p. 120, tab. xi.

† Dr. Coxe calls it Ipomœa *Jalapa*. I am indebted to Dr. Coxe for a living specimen, which is now (November, 1832) under cultivation; and I am happy in having an opportunity of publicly acknowledging his polite attention, and returning him my thanks.

solved have the characters of resin. The first part, that dissolved in the ether, is the active part of the Resin of Jalap.

According to the analysis of M. Cadet de Gassicourt, 100 parts of Jalap consist of resin 10.0 ; starch 2.5 ; vegetable albumen 2.5 ; watery extract 44.0 ; ligneous principle 29.0 ; woody fibre and loss 12.0 ; = 100. M. Gobel found that this resin contains more oxygen than any other resin. Its constituents are—carbon 36.62, + hydrogen 9.47, + oxgen 53.91, = 100. The elder M. Henry analysed the three different kinds of Jalap found in the shops. He found they all contained the same components, resin, fecula, extractive, and woody fibre ; but varied considerably in the proportions of these ingredients. Thus he found in 500 parts of

	Extract.	Resin.	Fecula.	Residue.
Sound Jalap	140	48	102	210
Worm-eaten Jalap...	125	72	103	200
Light Jalap............	75	60	95	270

From this, it appears that the larvæ, which feed on the Jalap, eat the extractive part and leave the resin; and, as this is the most active principle of the root, it is more advantageous than otherwise to select those tubers which are penetrated by larvæ. As the extractive and fecula are also slightly purgative, it has been supposed that the combination of those three principles is essential for the due operation of Jalap ; but I am of opinion that the chief advantage, both of the fecula and the extractive, is to obtund the activity of the resin. The fecula is perhaps in larger quantity than we infer from M. Cadet de Gassicourt's analysis, as it is readily detected by Iodine*.

When administered in a moderate dose, Jalap is a certain purgative, operating without griping : but in large doses it gripes and produces copious watery evacuations. When

* Mr. Hume, an intelligent chemist in Long Acre, obtained a substance from Jalap by an operose process; and, regarding it as the active principle of Jalap, he named it *Jalapine*. Only five grains are obtained from an ounce of the root : it has neither taste nor odour ; is scarcely soluble in either cold or hot water ; and completely insoluble in ether. No therapeutical trials have been made with this substance ; but, from the result of M. Pelletier's experiments with the Sulphate of Jalapine, sent to him by Mr. Hume, I am not disposed to regard it as the active principle of Jalap.

overdosed, it excites inflammation of the intestines. Placed in contact with serous membranes, injected into either of the cavities of the chest or the abdomen, it purges violently, excites inflammation and gangrene, and augments greatly the hepatic secretion. When united with lard, and rubbed upon the skin, it also causes severe purging; but, what is singular, when injected into the veins, it produces no effect. Thence we may presume that it acts on the nerves. It is generally given in combination with calomel, bitartrate of potassa, and other neutral salts: and, as its activity is greatly modified by the fineness of the powder, it is probable that its augmented activity in these combinations is in part owing to the minute division of its parts. It is rendered active and deprived of its griping quality by combining it with camphor. The watery extract, owing to the mildness of its operation, is well adapted for children. The simple resinous extract gripes violently, and exhibits all the characters of a drastic Cathartic without purging much. Combined with the bitartrate of potassa, it operates as a hydrogogue, producing thin and watery stools, and the deposition of fluids in the serous cavities is diminished. Jalap is chiefly useful, as a general purgative, in febrile affections connected with an increased action of the liver and a more than natural discharge of vitiated bile in the duodenum. The powder of the root is the best form in which it can be administered, either alone or in combination. The dose is from ten grains to half a drachm*.

2. RHUBARB. *Rhei Radix.* L. E. D.—In the British Pharmacopœias this root is said to be that of the Rheum *palmatum* and R. *undulatum*, plants belonging to the natural order Polygoniæ. But many doubts are still and properly entertained on this subject. The first, the R. *undulatum*, was supposed to be the plant; because some plants raised in Chelsea garden from seeds transmitted by Jussieu, who received them from Russia in 1702, proved to be the R. *undulatum*. This opinion, however, was dropped in favour of the R. *palmatum*, which was first raised in the Botanic Garden of Edinburgh in 1762, from seeds sent from Petersburgh by Dr. Mounsey, as those

* Jalap was unknown to the Greeks and Arabians, and indeed to Europe also, until after the discovery of America.

of the true Rhubarb. But the enquiries of Pallas, and other naturalists, procured no information in favour of either of these species; on the contrary, the Bucharians, who are the dealers in Rhubarb with Russia, declared that the leaves of the *palmatum* were unknown to them*.

Another species of Rhubarb, brought home by Dr. Hamilton from the Himalayan mountains, and described by Mr. Don under the name Rheum *Australe*, has been confidently asserted to be the true Rhubarb plant. The best account of it is given in the Transactions of the Calcutta Medical Society, by Mr. Royle, who states that it is found in great quantities in the Choor mountains, in lat. 30°, at an elevation of about 9000 feet. He also states that a Mr. Gerard reports that the table land of Tartary is covered with Rhubarb, at the height of 16,000 feet; and that some very fine specimens of it were transmitted to a Captain Kennedy, from Ludak, in lat. 37°: but it does not appear that the Rheum *Australe* yields the true Chinese or Russian Rhubarb†. There is some reason for thinking that the Rheum *compactum* yields the Rhubarb known by the name of the East Indian Rhubarb, and which is less valuable than that brought to us through Russia.

Rheum *Australe*, the R. *Enodi* of Wallich, like the other species of the genus, is an annual plant with a perennial root. It grows to the height of from six to eight feet. The whole plant is rough and beset with bristles or small points; the leaves are alternate, supported on red, deeply furrowed petioles, they are subrotundo-cordate, and of a dull green colour. The inflorescence is a loose panicle, very much resembling that of our common dock, Rumex *patientia*.

There are two kinds of Rhubarb known in commerce, the *Russian*, which is the best, and the *East Indian*.

Although the real species of Rheum which yields the Russian Rhubarb be still unknown, yet it is well ascertained that the root is collected in Chinese Tartary, on the hills surrounding the lake Koko Norr, and at the source of the great river

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* For the botanical characters of Rheum *palmatum*, see Woodville's Med. Bot. 3rd edit. p. 662, pl. 231. London Dispensatory, art. Rheum.

† Transactions of the Medical Society of Calcutta, vol. iii, p. 440.

Chong-cho*. The same pains is certainly not taken to select good Rhubarb at Canton as at Kiachta, the intermediate town between the Russian and the Chinese territories, where the Bucharians carry on their traffic with the Russians in Rhubarb. Experiments have been made in Europe, particularly in France, to naturalize and cultivate Rhubarb ; but every effort has hitherto failed :—a failure which cannot be certainly ascribed to the species being different from the Mongolian Rhubarb, but may depend either upon this circumstance, or upon our ignorance of the method of drying and curing the roots.

Good Rhubarb, of the variety named *Russian*, is in flat, irregular, angular pieces, frequently pierced with a hole large enough to admit the finger of an adult. Exteriorly, it is of a lively yellow colour; interiorly, it is mottled with red, yellow, and white, very irregularly, but sometimes as if radiated. It is somewhat spongy, and thence not easily cut ; its odour is aromatic ; its taste slightly astringent, bitter, and peculiar ; it feels gritty between the teeth ; and, when chewed, tinges the saliva yellow. It is easily pulverized, and affords a powder of a bright buff-yellow colour.

Chinese and East Indian Rhubarb, as it is termed, is in cylindrical, compact pieces ; sometimes, but rarely, pierced with small holes, merely sufficient to pass a cord through, by which it may be suspended during its desiccation. Its colour on the exterior is of a duller yellow than that of the Russian variety, and the marbling in the interior is more of a brick-red. In taste and odour it resembles the Russian Rhubarb ; but it is stronger. It colours the saliva with an orange-yellow tinge, and it crashes more under the teeth than the Russian variety ; it is also heavier, and the powder is of a colour between a fawn and orange-yellow. These two kinds of Rhubarb also differ in their chemical properties.

Water, at 212°, takes up 24 parts in 60 of Russian, and 30 in 60 parts of East Indian Rhubarb. The infusion of the Russian is of a deeper colour and less turbid than that of the East Indian : both redden tincture of litmus, owing evi-

* For the mercantile history of Rhubarb, and the method of drying it, see London Dispensatory, art. Rheum.

dently to free malic or free oxalic acid. The latter is copiously precipitated on the addition of lime water to the infusion, and exists in the state of a binoxalate of lime*. With the infusion of Russian Rhubarb, persulphate of iron strikes a dark olive colour; with that of East Indian Rhubarb, a more decided green: in the former, the precipitate is slowly formed; in the latter, the precipitate is copious and sudden: solution of gelatin precipitates both, but the precipitates are of different colours. From these effects, and from those of other reagents on these infusions, there is every reason for concluding that these two kinds of Rhubarb are roots of different species, although this difference may arise from soil and climate, as well as from the roots belonging to distinct species of Rheum.

Many distinguished chemists have, at different periods, endeavoured to ascertain what is the active principle of Rhubarb. Scheele, and Model of Petersburgh, failed in their attempts, but ascertained that the cause of the grittiness of Rhubarb, when chewed, depends on oxalate of lime, a substance which I found in large quantity in my analysis of both kinds; and which has been found by every one who has examined the components of Rhubarb, with the exception of Mr. Brande, who mentions neither oxalate nor oxalic acid in his analysis†. M. Henry found in both Rhubarbs—1. a yellow colouring principle; 2. a bland oil; 3. amylaceous fecula; 4. gum; 5. tannin; 6. oxalate of lime, in quantity one-third the weight of Rhubarb; 7. supermalate and sulphate of lime, and salts of iron and potassa‡. Other principles were found by Pfaff, M. Peretti, and M. Bressy; but in none of these analyses was any thing discovered which could be regarded as its purgative principle. Pfaff, by acting with water upon the root of Rheum *palmatum*, obtained a deep-brown substance, brilliant, opaque, and bitter, which

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* Binoxalate of potassa is found in large quantity in the stems and leaves of the Rheum *palmatum*, and the recent root of that plant. The acid in this salt was mistaken for a new acid by Mr. Henderson, who named it *Rheumic acid;* but M. Lassaigne has proved its identity with oxalic acid.

† Thomson's Ann. of Philosophy, vol. xvii, p. 469.

‡ Bulletin de Pharm. tome vi, p. 87.

displayed no acid reaction. He called it Rhabarbarine*. Caventou obtained from the alcoholic extract a yellow chrystallizable substance, insoluble in cold water, soluble in hot water, in alcohol, and ether, having the odour of Rhubarb, and a sharp, bitter taste ; but even this cannot be regarded as the purgative principle of the drug. Another principle has been obtained by treating one part of Rhubarb with eight parts of nitric acid in a gentle heat, until it acquires the consistence of syrup ; then straining and diluting with water, a precipitate falls, which is inodorous, bitter, orange-coloured, and soluble in alcohol and ether, and has been named *Rheine;* but this is not the purgative principle. It is evident, from all the analyses, that Rhubarb contains resin, rhabarbarine, extractive, sugar, gum, tannin, gallic acid, bi-malate, and binoxalate of lime. Upon the whole, I am disposed to think that the purgative property of Rhubarb is combined intimately with the resin, as the alcoholic tincture takes up every thing active, whilst the marc that remains is altogether inert.

From the fact of Rhubarb acting on the bowels when applied to the skin, without appearing in the urine, it is evident that its operation is wholly on the nerves ; and it is probable that the colouring matter only passes through the kidneys and is detected in the urine when the drug is taken into the stomach—an excellent illustration of the fact, that substances which are partially digested, and the components of which are partly carried into the circulation, may still owe their activity as remedial agents solely to their operation on the nervous energy. When Rhubarb is taken into the stomach, its colouring matter can be detected a few hours afterwards in the urine, the perspiration, and, if the person be a nurse, in the milk, to which it imparts colour and some degree of bitterness.

Rhubarb, as a therapeutical agent, is administered in the form of powder, infusion, and tincture. On the Continent, an alcoholic extract and a syrup of Rhubarb are also employed. As a purgative, the dose of the powder should be from ℈ss to ℈i : that of the infusion, made with ʒiii of the

* Syst. der Mat. Med. Bot. iii, p. 30.

bruised root and f℥viii of water, from f℥i to f℥ii*. The tincture can scarcely be given in doses sufficiently large to prove purgative.

Rhubarb in any form is a gentle purgative: its operation, however, is accompanied with gripings, although it rarely produces much excitement. In moderate doses, especially when administered in the form of powder, the influence of the tannin which it contains counteracts its purgative properties, and it displays astringent properties: thence, in a weakened state of the digestive organs, this property may prove useful, by increasing the appetite and affording tone to the stomach, even when the dose is sufficient to purge. From the mildness of its cathartic powers, it is well adapted for the diseases of infancy.

Rhubarb has been extolled as a vermifuge; and, as it has a tonic influence, it may prove useful; but it is not sufficiently active to clear the intestinal canal from worms; and, therefore, requires to be combined with more efficient purgatives for that purpose.

Rhubarb may be advantageously combined with calomel, jalap, scammony, and sulphate of potassa. It moderates their activity, and counteracts their tendency to lower the tone of the alimentary canal. Magnesia tends to obviate the griping property of Rhubarb; and, as most of the diseases of infants, in which purging is indicated, are accompanied with an acescent state of the stomach, it is an ordinary addition to Rhubarb in these cases. In some idiosyncracies it has produced epilepsy; and, consequently, when that occurs during its use, it should be discontinued.

1. Dock Root. *Radix Rumicis.*—This is the root of Rumex *Aquaticus*, the great water dock†, a plant belonging to the same natural order as the genus Rheum; but the root of Rumex *obtusifolius*, Broad-leaved Dock, possesses the same properties. They are both indigenous plants. The *Aquaticus* is supposed to be the Herba Britannica of the an-

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* The officinal infusion of the London Pharmacopœia acts as a tonic in these doses; that of the Edinburgh as a purgative.

† Woodville's Med. Bot. 3rd edition, p. 658, pl. 229.

cients, a plant noticed by Dioscorides as a specific in cutaneous diseases*.

In an analysis of the root of Rumex *acutus*, M. Deyeux found sulphur, fecula, binoxalate of lime, and vegetable albumen; and, as its properties closely resemble those of the roots of the above-mentioned species, it is likely that they contain the same principles.

Like rhubarb, Dock Root is astringent or purgative, according to the extent of the dose; and, like rhubarb also, its colouring principle is taken into the circulation, and excreted by the kidneys and the skin. In doses of f℥ii of a decoction, made with ℥i of the dried root, bruised, and one pint of water, it purges freely, producing bilious evacuations from its action on the orifices of the gall ducts in passing through the duodenum. It is prescribed with advantage in jaundice; but its chief administration has been in cutaneous affections, especially ichthyosis, in which it operates almost as a specific.

d. RESINO-EXTRACTIVE.

The chemical characters of Extractive have been already noticed. In the present instance, it is combined with Resin, and forms the chief component of a very excellent class of purgatives, the Aloetic.

The genus Aloë is an extensive one, and all the species yield a proper juice, which is more or less purgative: it belongs to the natural order Asphodeleæ. The genus consists of succulent plants, with thick firm leaves, which exhale little, but absorb powerfully by the surface†; and this function is one of great importance, as the whole family consists of plants which, growing on dry, arid soils, and in tropical climates, can imbibe little nutriment by their roots, which serve rather as props to maintain them in the erect posture than as nutritious organs.

The secreted juice of the medicinal Aloë exudes naturally from cracks in the leaves of the plants; and, concreting upon

* Muntingin's Diss. Hist. Med. de Vera Herba Britannica.

† When the leaf of an Aloe is separated from the plant and left on the ground, many weeks pass before it is shrivelled; but if it be then thrown into water, it acquires its original plumpness in a few hours.

the leaves, in the form of small, transparent granular tears of an obscure reddish brown colour, they are, in this state, called *lucid aloes*. But this form of aloes is very rare, and found only in the cabinets of natural history.

There are three kinds of aloes known in commerce: the *Soccotrine*, the *Hepatic*, and the *Caballine*.

1. SOCCOTRINE ALOËS. *Aloë Soccotrina*. E. D.—*Aloës Spicatæ Extractum*. L.—Soccotrine Aloës*, as its name imports, was originally obtained from the island of Zocotora, which was discovered by the Portuguese in 1503, situated in the mouth of the Red Sea, in the Arabian Province of Hadramant, contiguous to Yemen ; but the greater part of the best Soccotrine Aloës, now imported into Europe, comes from the kingdom of Melinda and the Cape of Good Hope. The plant which yields the Aloës at the Cape is the Aloë *spicata*, which rises with a thick round stem about four feet in height. The leaves are stiff, spreading, thick, and broad at the base, gradually tapering to a point, channelled, acute, toothed, and about two feet in length.

In the island of Zocotora, in Melinda, and at the Cape of Good Hope, the leaves of the plant, which are fleshy and succulent, are cut close to the stem, and the juice allowed to run out. After remaining at rest until the feculent matter subsides, this juice is poured into flat dishes and evaporated in the sun. At the Cape, the juice is inspissated by heat. These Aloës are imported in chests and casks, and sometimes in skins.

The real Soccotrine Aloës are in pieces of a dark, reddish-brown colour, glossy as if varnished, and having the thin edges, and small fractured pieces, reddish, or golden-yellow and semitransparent. These Aloës have a peculiar aromatic odour, not unlike that of the russet apple in a state of decay, and a very permanent bitter taste. They soften in the hand, and are adhesive ; yet they are easily powdered, except in very warm weather. The powder has a golden yellow colour. The Cape Aloës are of a more yellow hue on the outside, less glossy, and are softer and more pliable than the real

* Woodville's Med. Bot. 3rd edition, p. 767, pl. 260. London Dispensatory, art. Aloës.

Soccotrine. The colour of the powder more resembles that of camboge than that of the true Soccotrine Aloës. If a fragment be applied to the flame of a candle, it melts, swells, and inflames.

Soccotrine Aloës are dissolved by cold water when triturated in a mortar with successive portions of the fluid ; and the solution becomes frothy on being agitated. When the solution is left at rest, a portion of the Aloës is deposited. They are entirely soluble in boiling water ; but, on cooling, also let fall a resinous matter, which dissolves in alcohol without leaving any residue. The portion dissolved in water contains more of the bitter principle than that dissolved in alcohol. Tromsdorff analysed Soccotrine Aloës, and obtained 75 parts of a bitter, saponaceous principle, soluble in water and alcohol, but insoluble in ether ; 25 parts of resin, and a trace of gallic acid, in 100 parts*. Braconot, also, analysed this kind of Aloës. He found that the aqueous solution reddens the tincture of litmus ; that the alkalies and lime water deepen the colour, but cause no precipitation ; the persulphate of iron produces a brown precipitate ; and the decoction of galls a yellow flocculent one, with a supernatant fluid which is less coloured than the solution, and loses some of its bitterness. He also found that the subacetate of lead, in causing a precipitation, throws down also a large proportion of the colouring matter. When the aqueous solution is evaporated to dryness, the extract is soluble in alcohol and not in ether. From the action of these reagents, Braconot concluded that Aloës contain no *resin*. The free acid is evidently the gallic, and the precipitate by the subacetate of lead is gum. He found also that Soccotrine Aloës are entirely soluble in alcohol ; and thence, in my opinion, he too hastily concludes that they contain neither gum nor extractive. The fixed alkalies form saponaceous solutions with Aloës, which are precipitated by the mineral acids. From these results, Braconot concluded that Aloës is a principle sui generis, to which he proposed to give the name Resino-bitter. Bouillon la Grange and Vogel, however, also analysed Soccotrine Aloës, and found that, besides sixty-eight parts of a soapy

* Bulletin de Pharmacie, tome i.

extractive, they contain thirty-two of pure resin, which dissolves perfectly in alcohol, and remains long unacted upon by water, but at length communicates both colour and taste to the fluid. These chemists found also that the Soccotrine Aloës are resinified in chlorine. Both Guyton Morveau and Fabroni obtained colouring matters, all adapted for dying silk, from the recent juice of the Soccotrine Aloë. But the most important results from the chemical action of different substances on Aloës were undoubtedly discovered by Braconot.

By digesting eight parts of nitric acid on one part of Aloës, until reaction ceases, and diluting the residue with water, a reddish-yellow precipitate is formed, which becomes pulverulent when washed and dried, and assumes a beautiful golden-yellow colour. This is the bitter principle of Aloës; and, according to the experiments of M. Leibeg, it consists of a peculiar substance approaching in its character to resin, and of an acid which, from its being a compound of carbon, azote, and oxygen, is termed carbazotic. The washing of this principle, when evaporated, yields yellow, rhomboidal, opaque crystals, scarcely soluble in water, which are a compound of this bitter principle and oxalic acid; most probably the result of the action of the nitric acid on the extractive of the Aloës.

The bitter principle of Aloës requires 800 parts of cold water for its solution. It is more soluble in hot water. With both it forms a beautiful rose-purple coloured solution, which, when boiled with silk, communicates to it a permanent colour, that neither soap nor any other substance effects, except nitric acid, which changes it to yellow; but it again assumes its proper colour when washed with water. By the aid of mordants, it dyes flannel of a beautiful black, which is not altered by light. With potassa this bitter principle forms a purple salt, which precipitates the salts of baryta, those of lead, and the peroxide of iron, of a deep purple hue, and the protonitrate of mercury of a deep red. Whether this bitter principle is the cathartic principle of the Aloës, requires yet to be determined. I took one grain of it at bed time, and was freely moved next morning; but, as I was anticipating such

an effect, I do not consider that much dependence can be placed upon this trial.

When the Soccotrine Aloës are distilled, a volatile oil is obtained, which is not procured from the Barbadoes Aloës; and it is this oil that gives the peculiar odour to the Soccotrine Aloës.

2. *Barbadoes Aloës. Aloë Hepatica.* E. D.—This is the production of the Aloë *vulgaris*, the Aloë of Dioscorides and the Greek physicians*. It is a native of the island of Cyprus and other parts of the Levant, the coast of Barbary, and the Island of Barbadoes. For its preparation, the leaves of the plants, which are more succulent than those of the spiked Aloë, are cut close off at the stem and disposed in tubs to permit the juice to run out; after which it is boiled until it acquire the consistence of honey, when it is run into calabashes, that is, empty gourd shells, each of which contain from sixty to seventy pounds weight. Caballine Aloës are said to be the refuse of this process.

Barbadoes Aloës have an odour which is thought to resemble that of the human axilla: the taste is more nauseous and intensely bitter than that of the Soccotrine Aloës. The fracture is less smooth, but more splintery, and the surface of the pieces of a duller brown colour and less glossy than the Soccotrine. The colour of the powder is a dull olive yellow.

Barbadoes Aloës do not dissolve so completely in boiling water and in alcohol as the Soccotrine; and by this means the substitution of the one for the other is readily detected. M. Tromsdorff found that 13 parts in 16 are taken up by water; that the solution displays acid properties, and precipitates salts of iron. The residue left by the aqueous solution is only partially acted on by alcohol, which dissolves one third, leaving two thirds, which are coagulated vegetable albumen. Hepatic Aloës, with the exception of this albumen, are completely soluble in alcohol: thence Tromsdorff concludes that the chief distinction between this kind of Aloës and the Soccotrine is the presence of vegetable albumen; and this partial solubility in alcohol readily distinguishes the *Hepatic* from *Soccotrine* Aloës.

* Woodville's Med. Bot. 3rd edition, vol. v, p. 98.

Tromsdorff concludes, from all his experiments, that Soccotorine Aloës consist of

a saponaceous bitter principle	75
Resin	25
Traces of gallic acid	00
	100

That Hepatic Aloës consist of

a saponaceous bitter principle.......	81.25
Resin	6.25
Albumen..................................	12.50
Traces of gallic acid	00.00
	100.00

3. *Fœtid, or Caballine Aloës.*—I am ignorant of any plant which only yields this variety of Aloës. It is easily distinguished from the two former varieties by its rank fœtid odour. It resembles common resin in its fracture. It is only used in veterinary medicine: and is supposed to be the refuse of the process for making Hepatic Aloës.

Aloës is a warm, stimulating purgative, which exerts very little, if any, action on the duodenum and small intestines, but affects the colon and especially the rectum, evacuating the latter fully, yet without causing watery stools. This peculiarity in the operation of Aloës has been referred to its little solubility in the fluids of the intestinal canal, permitting it to pass nearly through the whole length of the canal before it is sufficiently dissolved to exert its stimulant effect. But those who reason in this manner have forgotten that Aloës, when applied to an ulcer on the neck, acts on the rectum. In whatever manner the effect is to be explained, this fact is undoubted.

All the kinds of Aloës exert the same medicinal influence. The ancients employed the Barbadoes Aloë, and used it both internally and externally. As an internal medicine, they regarded it less hurtful than any other purgative, "ideoque," says Celsus, "omnibus Catharticus Aloë miscenda est." They applied it to ulcers and wounds, combined with other medicines; and as a lotion in some species of ophthalmia, a practice which is at this day followed by the Tamool physi-

cians, in India, who also use it, toasted, in some bowel complaints of puerperal women. When Aloës are administered in moderate doses, the functions of the digestive organs are improved; but when these are labouring under excitement and the tongue becomes dry, when there is thirst, heat, and pain in the abdomen, then their employment should be intermitted.

Aloës is said to act equally well in small as in large doses; but this assertion does not accord with my experience; and it is only in large doses that I have ever seen this medicine bring on an attack of hæmorrhoids. The usual dose of Aloës is from five to ten grains; a dose which does not require to be increased, even under the habit of taking the medicine to relieve habitual costiveness for any length of time. As a remedy in such cases, Aloes is a very useful evacuant, as it is a warm and stimulant medicine, not producing flatulence; and in the costiveness of dyspeptics, particularly those of sedentary and hypochondriacal habits, the intestines require a stimulus, being generally in a sluggish and insensible state It has been thought peculiarly well adapted for cases of jaundice, on the supposition that it may supply, to a certain extent, the bitter of the bile which is deficient. It is certainly useful in obstructions of the biliary duct; but in such cases it requires the combination of alkalies, and of calomel or the blue pill, to stimulate the orifices of that duct, which is little affected by the Aloës alone in its passage through the duodenum.

Dr. Cullen, in his work on Materia Medica, asserts that nothing is gained by combining Aloës with other substances; but this opinion is at variance with the results of experience: no medicine is more modified by combination than Aloës. When combined with soap or an alkaline salt, it operates more quickly; but with much less violence and with considerably less irritation on the rectum. It is also usefully combined with scammony, colocynth, aromatics, salts of iron, myrrh, and the fœtid gum-resins. One of the best forms of combination, when it is desirable to improve the power of the digestive organs, and at the same time open the bowels, is the following:

℞ Myrrhæ ʒvi
Sodæ Subcarbonatis ℥iii
Ammoniæ ʒivss
Aloës extracti ʒvi
Vini albi (Anglice, Sherry) f℥xxiv.
Macera per dies vii et cola.

Two table-spoonfuls of this vinous compound may be taken, twice a day, in a fluid ounce of a solution of extract of liquorice.

From the peculiar action of Aloës on the rectum, they are supposed to be contraindicated in hæmorrhoids and in pregnancy. In the former, if the dose be small, I have never seen any increase of the pain or irritation excited; and many of the numerous nostrums, under the name of dinner pills, into which Aloës enters, are daily taken with impunity by those liable to piles. It is not necessary, however, to order Aloës to patients labouring under hæmorrhoids, in the face of a general opinion; but, when other circumstances indicate the use of Aloës, we need not be prevented from ordering them. In the same manner Aloetics are generally condemned in pregnancy; but Dr. Denman has remarked that "they are in common use among the lower classes of persons, because they are cheap and conveniently given in the form of pills;" and no bad effects are observed to follow their use. Aloës, however, ought not to be administered during the menstrual discharge; nor in those cases in which there is much uterine irritation and a tendency to discharges from the uterus, either more frequently or in larger quantity than is natural.

Aloës enters into various officinal preparations; and, in almost every form in which they are prescribed, they constitute a valuable purgative. Should the bitter principle be found to act with certainty and in much smaller doses than crude Aloës, the preparation of it would be so far valuble that it might be obtained from the worst species of Aloës as well as the best; and, therefore, in equalizing their operation, it would prevent those inconveniences which sometimes arise from employing the more irritating kinds of this drug.

It is usually stated that, owing to the bitter, nauseous taste

of Aloës, pill is the best form of exhibiting it; but I know of no medicine that is so soon reconciled to the palate, even of children, as the preparation with the alkalies and the wine which I have described, when it is given in a solution of the extract of liquorice. The dose is from six to sixteen grains; but, if taken daily, the dose should not exceed six grains; as, in larger doses, when the use of the medicine is continued for some days, it is apt to induce symptoms of tenesmus.

e. CATHARTINE.

This principle was discovered by MM. Lassaigne and Feneulle in senna, in which it is combined with extractive and some other vegetable constituents. Cathartine is crystallizable, of a reddish-yellow colour, has a peculiar odour and a bitter nauseous taste. It is soluble in water in every proportion, attracting, even in its dry state, moisture from the atmosphere: it is insoluble in ether. The solution of Cathartine is precipitated by infusion of galls in yellow floculi; the subacetate of lead acts on it in the same manner; but the acetate does not affect it. The alkalies and the persulphate of iron deepen the colour, but do not throw down precipitates in the solution of Cathartine. Heat decomposes and resolves it into carbonic acid, acetic acid, hydrogen gas, empyreumatic oil, and charcoal.

SENNA *(Sennæ folia,* L. E. D.), of which the substance I have just described is supposed to be the active principle, consists of the leaves of several species of *Cassia*, a genus of plants belonging to the natural order Leguminosæ*. Three species of this family are particularly pointed out as supplying the Senna of commerce. The first is the

Cassia *Senna*, or *Acutifolia* of Delile and Richard. It is a small plant, which grows abundantly in Upper Egypt, near Syene in Nubia, where it is called *Abyreyga;* in Sennaar, and at Bernou in Central Africa. It forms the true Alexandrian Senna. The Alexandrian Senna, however, as we receive it, is a mixture of the leaves of this plant, the footstalks of the leaves,

* Woodville's Med. Bot 3rd edition, p. 442, pl. 159. London Dispensatory, art. Senna.

and the pods; with an admixture of various leaves with which the Senna is adulterated at Alexandria. These are the leaves of the Cassia *obovata*, those of the Cynanchum *Oleæfolium*, and occasionally those of the Colutea *arborescens*, or Bladder Senna. M. Bouver and Dr. Calloden inform us that Alexandrian Senna is compounded at Boulac of the following leaves: five parts of Cassia *acutifolia;* three parts of Cassia *obovata;* and two parts of Cynanchum *oleæfolium*, or Argel, as it is termed. The leaf of the true Senna (see fig. 1) seldom exceeds nine lines in length, is oblique at the base, and unequal on each side of the mid rib, *a*, *b*, pointed and veined on the under side. The leaves of the Cassia *obovata* (fig. 2) are, as the name of the plant implies, obovate, obtuse, with a minute point, *c*, which is the prolongation of the mid rib; narrow, unequal, and cuneiform at the base, *a*, *b*, and slightly pubescent. The leaves of the Cynanchum (fig. 3), or Argel, are an inch, or fourteen lines in length, pointed, equal at the base, unequilateral, but with one side, *a*, straighter than the other, *b*, and without any lateral nerves on the under disk. The Senna known by the name of *Tripoli Senna*, consists also of the Nubian Senna, the Cassia *acutifolia;* the leaflets are smaller than those in the Alexandrian Senna, and more broken; but they are free from any admixture either of pods or the leaves of the obovate Senna, or those of Argel.

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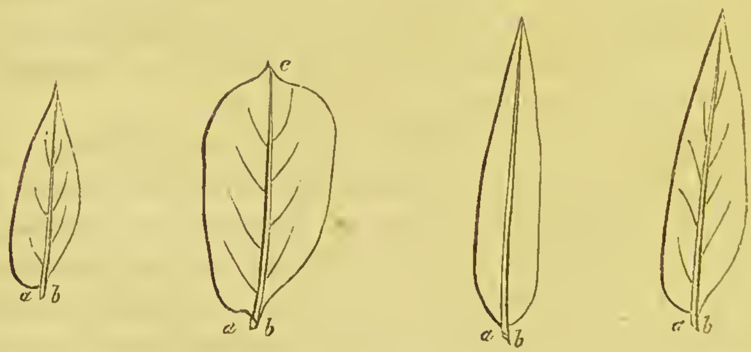

The C. *obovata* is a smaller plant than the C. *acutifolia:* it is a native of Syria, Egypt, and Senegal. I have already

described the form of the leaflet: it constitutes the Senna known by the name of Aleppo Senna, which is rarely brought to this country, unless in mixture, as I have already stated, with Alexandrian Senna.

The third species of Senna, the Cassia *lanceolata* of Forskahl, is known in this country by the name of *East Indian Senna*, although it is not a production of India, but grows at Abuarish in Arabia Felix, and is exported from Mocha. Its leaflet (fig. 4) is upwards of an inch in length, and unequal at the base, *a*, *b*. It is known in the Indian bazaars by the name of Sena Mekki. The same species of Senna is cultivated in considerable quantity at Tinnivelly, on the Malabar coast: it is imported in large quantity into this country under the name of Tinnivelly or East Indian Senna, and fetches a high price in the London market. It is milder in its operation than the Alexandrian drug; is as certain a purgative, and operates without griping. It has not, however, been adopted into general use in Great Britain.

Cassia *Marilandica*, a plant found over all the United States, seems to be also a variety of the C. *lanceolata*. It differs from the C. *acutifolia* and the C. *obovata*, in being a shrub of three or four feet in height, by having glands at the base of the petioles of the leaflets, and by the smoothness and length of the leaflets, which are nearly two inches long, straight, and nearly subulate.

Senna is collected twice a year, in the vale of Bichariè, near Syène. The plants are cut down and dried in the sun; the leaflets are then separated, packed in bales of date leaves, and sent to Boulac, where the admixture which I have described takes place. The quantity of Senna sent to Boulac is about two millions of pounds, and nearly double that quantity is imported into Europe.

Senna leaves, as the leaflets are termed, have a faint, sickly, disagreeable odour, and a slightly bitter, aromatic, sweetish taste, very nauseous to the palate of most people. Besides Cathartine and Extractive, the analysis of Senna has discovered in it—1, a fat oil; 2, a fixed and volatile oil; 3, albumen; 4, a yellow colouring principle; 5, mucilage; 6,

malate and tartrate of lime; 7, acetate and sulphate of potassa and chlorophylle, or the green colouring matter of plants*. Water at 96°, if allowed to stand on the leaflets for twenty-four hours, takes up all the active matter of Senna, without the griping matter, which is dissolved in boiling water. When the Senna is boiled, the volatile principles are dissipated, the extractive is oxidized, and probably some change takes place in the resinous principle which promotes griping. Various reagents affect the infusion. Oxalate of ammonia decomposes the salts of lime, and throws down a precipitate: the mineral acids, it is said, throw down the albumen; but this is incorrect; it is effected by nitrate of silver and corrosive sublimate. The infusion should not be kept ready made, as the extractive becomes oxidized and the cathartine decomposed, and the medicine is thus rendered inert as a purgative, but gripes violently. When the infusion is shaken in chlorine gas, the extractive combines with the chlorine, forming a compound, which is insoluble in water, but soluble in alcohol, the mineral alkalies and in ether, thereby indicating its approximation to resin. If the infusion with hot water have a pale yellow colour and an astringent taste; if gelatin throw down a white precipitate; and the precipitate by corrosive sublimate and emetic tartar be great; if sulphate of iron produce a blue precipitate; and nitrate of silver a black; whilst, at the same time, the nitro-muriate of gold produces an instantaneous black; or caustic potassa a gelatinous precipitate; M. Guibourt has determined that these appearances indicate an adulteration with the leaves of the Coriaria *myrtifolia*, a poisonous shrub.

Senna is a useful and very general purgative, there being scarcely any disease in which it cannot be administered. Infusion is the best form of giving the medicine; but the water with which it is made should only be tepid, for the reasons which I have already mentioned. The nauseous taste, so disagreeable to many, is said, by Dr. Paris†, to be covered by infusion of Bohea tea; milk and sugar being

* Journ. de Pharm. tome vii, p. 548.

† Pharmacologia.

added in the same proportions as in common tea. The purgative power of the infusion is greatly increased by the addition of camphor mixture, or the decoction of guaicum. The infusion of Senna is seldom given alone ; but the incompatibles should be well known to the prescriber, as some of them in common use—such, for example, as magnesia, rhubarb, and the carbonates of the alkalies—destroy its properties. The dose of the infusion is from f℥iss to f℥ii, which may be taken in conjunction with an aromatic, which the griping quality of the drug renders necessary, when the nature of the disease does not forbid the use of stimulants. The tincture is, also, a good form of preparation of Senna as an addition to the infusion ; but the raisins in the London formula are useless, and have been judiciously left out in the last edition of the Dublin Pharmacopœia. The confections or electuaries into which Senna enters are so compounded of other purgative substances, that it is difficult to say what part the Senna acts in these preparations. The syrup is a bad form for Senna, but the powder is worse ; indeed it is remarkable to see so bulky and inconvenient a preparation continue to hold a place in the Pharmacopœia of the London College.

** INORGANIC SUBSTANCES OPERATING AS PURGATIVES.

a. METALLIC OXIDES.

The only Metallic Oxides which are employed as purgatives are the protoxide of mercury, and a combination of mercury and oxygen which approaches to the state of the protoxide, the Hydrargyrum cum Magnesia of the British Colleges. I am aware that the nature of the latter is regarded as problematical ; but my reasons for considering the mercury in it as a protoxide remain unaltered by any of the objections which have been urged.

1. The Mercurial, or Blue Pill. *Pilula Hydrargyri.* L. E. D.—In this pill the oxide of mercury is combined with vegetable matter. It purges in some cases in any dose ; but in such instances its activity depends either on some peculiarity of habit or idiosyncracy ; or on an aces-

cent state of the stomach, in which the muriatic acid of the gastric fluid combines with the oxide, and gives the pill activity. This pill is seldom trusted to as a purgative, but is given in a moderate dose at bed-time, and carried off by a purgative in the morning, according to the plan pursued by Mr. Abernethy. It is most useful in diseases connected with a diminished secretion of bile.

2. Mercury with Magnesia. *Hydrargyrum c. Magnesia.* L. E. D.—In this preparation the Mercury is also oxidized. It is very mild in its operation, and is seldom employed except in cases where an alterative is required; or as a purgative for children, in whom there is much acidity of stomach, and at the same time some glandular obstruction. In such cases it is a useful purgative.

b. CHLORIDES.

These are combinations of chlorine and metallic bases.

1. Chloride of Sodium. *Sodii Chloridum. Sodæ Murias.* L. E. D.—The nature of this salt has been already examined under the head of Tonics; but as it operates also as a purgative, particularly as it exists in sea water, it is again necessary to direct attention to it. Sea water has been examined by different chemists, and although its constituents are found to be the same wherever it is taken up, yet the quantities of these differ greatly according to the part of the ocean, its distance from land, and the depth at which it is procured. It was also demonstrated, by Dr. John Murray, that the salts obtained from sea water differ according to the mode in which the water is analysed. Its specific gravity is 1.0269 to 1.0285; and it requires a temperature nearly four degrees under the freezing point, or 28.5° Faht. to freeze it. The average quantity of saline matter in it is three per cent., and this consists of Chloride of Sodium, sulphate of magnesia, sulphate of soda, muriate of magnesia, and muriate of lime; but it also contains hydriodic and hydrobromic salts in minute quantities. The active purgative principle is undoubtedly the common salt, or Chloride of Sodium.

Sea water has a bitter, saline taste. When taken into the

stomach in small doses, it operates as a stimulant tonic, first to the stomach itself and then on the general system; and on this principle its external application is tonic. When taken internally in the dose of about half a pint, repeated twice or three times at the interval of half an hour, it operates as a mild but very effectual purgative; and from its continued use in this quantity, for some weeks successively, very beneficial effects have been produced, and with less reduction of strength than follows the continued use of any other purgative. It has been successfully employed as a vermifuge, particularly when the worms are the ascarides, or thread worms; and in this case it has the advantage of giving tone to the system, whilst it clears the canal of the worms already existing in it.

Sea water has been frequently taken, with advantage, in habitual costiveness, particularly in those of full habits who lead a sedentary life. In this instance its stimulant properties are as useful as its purgative qualities. When it is to be given to children, they are easily persuaded to take the dose if its nauseous taste be covered with a little port wine. It is a curious fact, that by the continued employment of sea water as a purgative, although for a short time it produces emaciation, yet its secondary effect is to promote obesity, which must be attributed to its stimulant properties, acting on the glandular system, and thus increasing the powers both of the digestive and the assimilating functions. Although the Chloride of Sodium is undoubtedly the most active ingredient of sea water, yet it is true that the solution of this salt does not possess the same purgative qualities as sea water, nor can any artificial admixture of its components, in the average proportions in which they have been found by the best chemists, produce a compound of powers equivalent to those of natural sea water. It is not easy to acount for this fact; but it has prevented the employment of artificial sea water, even to the extent that artificial mineral waters have been used. In cases of ascarides, sea water is most efficacious when exhibited in the form of enema.

Although sea water cannot be regarded as a purgative of much power, yet in some constitutions it operates when no

other Cathartic will take effect. This is to be attributed to idiosyncracy; but it is a fact, the knowledge of which is of great practical importance. When sea water fails to purge, which it does in some habits, it produces fever of a low kind, accompanied with purple spots on the skin: this, however, cannot be attributed to the Chloride of Sodium alone; since, as I have already stated, sulphate of soda, muriate of magnesia, and muriate of lime, all of which are purgative, are also components of sea water.

2. Protochloride of Mercury. *Hydrargyri Submurias. Calomel.* L. E. D.—When intended to operate as a purgative, Calomel should be given in much larger doses than are usually prescribed; since, in such doses, it often allays the irritability of both the stomach and the bowels, which is not the case in small doses. Mr. Annesley, in his work on the Diseases of India, remarks that Calomel in large doses combines with and renders fluid, and detaches the viscid, mucous secretions adhering to the alimentary canal; it diminishes the vascular state of the stomach when this is in excess; and increases the vascular and capillary circulation in the mucous coat of the large intestines. The operation of Calomel, however, as a purgative is very uncertain; and it should be followed by a morning purge, to prevent its action on the salivary glands. It may be regarded as acting beneficially when the secretions are improved, without any effect being induced on the salivary glands. Experience informs us that, during the administration of Calomel, the appearance of the evacuations is rarely natural, being either greenish or slimy, and inodorous or fœtid. In more than one instance, I have seen clay-coloured stools always produced by Calomel. During a course of Calomel, therefore, as a purgative, the medicine should be frequently intermitted for a few days, to ascertain the real state of the contents of the intestines when the stimulant is withdrawn.

Like every other active remedy, Calomel may prove useful or otherwise, according to the manner of prescribing it and the state of the habit at the time.

c. SALTS.

1. SULPHATE OF MAGNESIA. *Magnesiæ Sulphas.* L. E. D.—Sulphate of Magnesia is found ready formed in many mineral waters, and was first prepared by the evaporation of those of Epsom. A large proportion of what is now used is manufactured from the bittern of sea-water, the mother ley that remains after the crystallization of sea-salt; this Sulphate being a component of sea-water, the quantity contained in the ley is about one-eighth. The salt thus obtained is again dissolved and recrystallized: but it still contains some muriate of Magnesia; and, therefore, the Sulphate made from the bittern deliquesces. To remedy this objection, Sulphate of Magnesia is prepared, in Italy and some other parts, from Magnesian Schistus, which contains Magnesia and a sulphuret of iron. By roasting this mineral, the sulphuret is decomposed by the oxidizement of the iron, whilst the sulphuric acid, formed by the oxygen evolved during the decomposition of water, with which the roasted mineral is moistened, combining with the sulphur, unites with the Magnesia as well as with oxide of iron, and forms Sulphate of Magnesia and Sulphate of Iron. The addition of lime decomposes the sulphate of iron, and forms an insoluble sulphate of lime, at the same time that it renders the iron insoluble, by reducing it to the state of an oxide; and thus it enables Sulphate of Magnesia to be readily separated by lixiviation and crystallization. In this country it is prepared by calcining magnesian lime-stone, then treating it with muriatic acid, in a quantity sufficient only to take up the lime; and, lastly, adding sulphuric acid to convert the Magnesia into the Sulphate, and crystallizing. The rationale of this process is very simple: the magnesian lime-stone contains carbonates of magnesia and of lime; the calcination expels the carbonic acid, and leaves Magnesia and lime; muriatic acid, diluted with ten or twelve times its weight of water, is then added in quantity sufficient only to take up the lime; the muriate of lime formed is held in solution, whilst the Magnesia, being insoluble, precipitates: the two products are now easily separated by decantation, and the Sulphate of Magnesia is formed by the addition of the sulphuric acid to the Magnesia. This

process was invented by Dr. Henry; and the salt so prepared, from containing no muriate of Magnesia, is not deliquescent; and, on that account, is preferable to that prepared from bittern.

When slowly crystallized, Sulphate of Magnesia forms either irregular, six-sided, or quadrangular prisms, surmounted by six-sided quadrangular pyramids, or by dihedral summits: but the crystals vary greatly, according to circumstances; and, as the usual form of the crystals is acicular, it is preferable to crystallize it in this form, which is effected by evaporating the solution to a pellicle. Whatever may be the modification of form of the crystals, they are all doubly refrangent; and also slightly efflorescent. The taste of Sulphate of Magnesia is extremely bitter; but it nevertheless accords better with the stomach in its most irritable state, than any other salt. It dissolves in its own weight of water at 60°, and in three-fourths of its weight of boiling water. In solution, the salt increases the bulk of the fluid $\frac{4}{10}$ths of its volume: thus a solution of ℥i of Sulphate of Magnesia in f℥i of water, will measure fʒxi and $\frac{1}{4}$.

When heated, Sulphate of Magnesia undergoes the watery fusion, and loses its water of crystallization; but is not decomposed, except in a white heat, when a portion of its acid is dissipated. Its constituents are sulphuric acid 32.52, + magnesia 16.26, + water 51.22, in 100 parts; or, 1 prop. sulph. acid = 40; 1 magnesia = 20.7; 7 water $(9 \times 7) = 63$, making the equivalent 123.7.

This salt, notwithstanding its cheapness, is occasionally adulterated with sulphate of soda. To determine the quantity of pure Sulphate of Magnesia, which any specimen of the salt contains, Mr. Phillips recommends the following process. Dissolve 100 grains of the salt in distilled water, and add to it an equal weight of subcarbonate of soda in solution; boil the mixture, and wash and dry the precipitate: the result should be thirty-four grains; and any deficiency is caused by an admixture of sulphate of soda. Or this adulteration may be ascertained by precipitating the Magnesia by hydrate of potassa, and the potassa by hydrochlorate of platina; after which the supernatant fluid is to be evaporated, to ascertain

whether it contains muriate of soda. Sulphate of Magnesia is decomposed by carbonate of ammonia, by carbonate of potassa, lime-water, salts of baryta, salts of lead, and muriate of lime. There is always an excess of acid.

As a purgative, Sulphate of Magnesia is a very valuable article of the Materia Medica. It purges without causing griping; but it often proves flatulent; and therefore requires to be conjoined with some aromatic tincture, or bitter infusion, such as cascarilla or calumba, or quassia. An elegant form of prescribing Epsom salts is in the infusion of confection of roses, acidulated with diluted sulphuric acid; in which form it allays the vomiting which often occurs in fevers, when other means fail.

Sulphate of Magnesia operates chiefly on the duodenum; and when exhibited in a full dose, from ʒiv to ʒvi, in a large quantity of tepid water, it operates briskly: but it generally requires some adjunct to ensure a decided evacuation of the intestines.

As I have already stated, Sulphate of Magnesia forms the active ingredient in many mineral waters. At *Aix*, in Savoy, it is conjoined with sulphates of soda and of lime, and a large proportion of carbonate of lime and Magnesia; in the *Barege* waters, with carbonate and sulphate of lime; in the *Kilburn*, *Moffat*, and several other waters, with sulphate of soda and sulphate of lime. The sulphate of soda, however, is a more common ingredient in mineral waters than the Sulphate of Magnesia. Mineral waters of this description are, therefore, merely combinations of various purgative salts, in conjunction with some gases and other substances, with which they cannot be united in an artificial state.

Much of the beneficial effects of mineral waters, of a simple purgative nature, arises evidently from the continuance of their use for a longer time than patients are generally willing to take artificial purgatives; from their daily employment being accompanied with exercise in the open air; from the great degree of dilution in which the salts are administered; and, not least, the freedom from business, care, and anxiety, which those who visit these springs generally enjoy. It has been the fashion of late to order mineral waters in private practice,

to patients residing in large towns, especially in the metropolis; but in doing so, the fact of situation and circumstances seem to have been forgotten; and also the fact, that the dilution, which is so useful at the springs, tends only to oppress the stomach and weaken the digestive organs in town, where the exercise, after the dose is taken, cannot be easily resorted to, and the habits of life are altogether different from those at watering places. The dilution aids greatly the purgative properties of the Sulphate of Magnesia in every situation: but it is preferable to drink the water, or whatever bland fluid may be employed, in a tepid state, half an hour after swallowing the dose of the salt, dissolved in a small portion of water, than to combine the two together. The purgative, in this case, is left to stimulate the excretory ducts of the liver and the pancreas, and to cause a copious discharge of the important secretion of the glands into the duodenum, where the fluid taken dilutes them, and aids in carrying them forward into the other intestines. It is by the augmented discharge from the biliary ducts, and the duct of the pancreas, that the principal benefit is derived, which accrues from the administration of this purgative. If the surface be freely exposed to cold air, the salt does not operate as a purgative, but as a diuretic; and, in some instances, it seems to pass off by the surface.

Under every form, whether prepared by the hand of Nature or of Art, Sulphate of Magnesia is a very valuable purgative.

2. Sulphate of Soda. *Sodæ Sulphas.* L. E. D.—Sulphate of Soda is generally prepared on a large scale, and at so low a price, that the process of the Pharmacopœias is seldom employed. In the officinal process, the excess of sulphuric acid left in the residue of the distillation of muriatic acid from sea-salt, is ordered to be saturated with subcarbonate of Soda, and crystallized; but the salt thus formed is not worth the price of the Soda employed. When well prepared and carefully crystallized, it forms in six-sided prisms, terminated by dihedral summits; these are usually channelled, and always exceedingly irregular. It readily effloresces in the air; and, when exposed to heat, undergoes

the watery fusion, losing the whole of the water of crystallization. The salt, when the water of crystallization is evaporated, becomes opaque and white. The taste of Sulphate of Soda is saline, bitter, and nauseous. It dissolves in three parts of water at 60°; in an equal weight of boiling water at 77°; and in one-third part at 91.5°; but it is a singular fact, that beyond this temperature it is less soluble, and boiling water takes up only an equal weight of the salt. It is insoluble in alcohol, which throws it down in its watery solution. According to the analysis of Berzelius, the crystallized salt consists of—sulphuric acid 24.76, + soda 19.24, + water 56, in 100 parts; or of 1 prop. acid = 40; 1 prop. soda = 31.3; 10 prop. water (9×10) = 90, making the equivalent 161.3.

If a saturated solution at 91.5° be evaporated at a higher temperature, opaque, anhydrous crystals of the salt, the primary form of which is a rhombic octohedron, are deposited.

This salt is contained in many mineral waters; it is also found in the ashes of many vegetables; and effloresced on brick walls, whitewashed with certain compounds, as on those in the lowest part of the London University. From a similar cause, it is found both crystallized and effloresced in some caves near the village of Muhligen, in the Canton of Argovie in Switzerland. The artificial salt was first prepared by Glauber, a German chemist, who named it *sal mirabile*; but it has been always more generally termed Glauber salts. Before the introduction of Epsom salts, the Sulphate of Soda was the most common purgative. It is now, however, not so generally employed. It is, nevertheless, a very certain purgative, and its nauseous taste is covered either by a little citric or tartaric acid. The muriates of lime and of magnesia, and the salts of lead and of baryta, decompose this salt; and are, therefore, incompatible with it in prescriptions. In the usual crystallized state, the dose is from ʒiv to ℥ii in any bland fluid.

Muriate of Soda exists only in solution; and it is employed as a purgative only as found in sea water.

3. Phosphate of Soda. *Sodæ Phosphas.* L.—Phosphate of Soda, according to the London Pharmacopœia, is

prepared from the superphosphate of lime, obtained from calcined bones by the action of sulphuric acid, subcarbonate of Soda being afterwards added. A double exchange takes place, the sulphuric acid unites with the lime, forming an insoluble sulphate, whilst the soda of the subcarbonate attaches itself to the phosphoric acid, forming a soluble phosphate; which, after filtration, to separate the sulphate of lime, slowly crystallizes. It generally contains some traces of sulphuric acid, if it be not repeatedly dissolved in distilled water and recrystallized. It may also be prepared by the direct combination of its constituents; but this is too expensive for medicinal purposes.

This salt forms in oblique, romboidal prisms, large, regular, and transparent, which effloresce when exposed to the air, losing their water of crystallization, and falling into an opaque, white powder. The taste of this salt is cooling, somewhat like that of common salt, a little more urinous, but not unpleasant; it dissolves in four parts of water at 60°, and in two parts of boiling water. When heated, it undergoes the watery fusion; and, in a red heat, melts into a white enamel. Muriate of magnesia and muriate of lime, acetate of baryta, and nitrate of silver, decompose this salt: all of these substances are therefore incompatible with Phosphate of Soda in prescriptions. It is often adulterated with sulphate of soda when it is in an efflorescent state. This may be discovered by dissolving 100 grains of the suspected salt in water, and adding to the solution acetate of baryta, as long as any precipitate falls. The deposite is then to be well washed and treated with nitric acid, which dissolves the whole if the phosphate be pure, but leaves an insoluble sulphate of baryta if it be adulterated with sulphate of soda. The weight of this indicates the extent of the adulteration.

According to the analysis of Berzelius, it consists of—phosphoric acid 20.33, + soda 27.67, + water 62.00, in 100 parts; and, according to Mitcherlich, it may be inferred to consist of—1 prop. phosphoric acid $= 35.7$, + 1 soda $= 31.3$, + $12\frac{1}{2}$ water $(9 \times 12, + 4,)$ $112.5 = 178.5$*.

Before this salt was artificially formed, it had been detected

* Turner's Elements of Chemistry, 4th edit. p. 675.

in urine and described by Hillot in 1737. Haught afterwards described it under the name of *sal mirabile perlatum:* but its real chemical constitution was first pointed out by the younger Rouelle in 1776, and his opinions were confirmed by Klaproth and Scheele. Dr. Pearson introduced it into use as a purgative.

From the similarity of the taste of this phosphate to that of common salt, it is a purgative well calculated for children, as it may be given in broth without being detected. It operates in doses of from ʒvi to ℥ii.

4. TARTRATE OF SODA. This salt is not ordered in any of the British Pharmacopœias; yet my experience authorizes me to recommend it strongly in dyspeptic habits, when extemporaneously prepared by adding gr. xv of the tartaric acid in solution, to a solution of ʒi of the bicarbonate of soda. The carbonic acid which is extricated acts as a gentle stimulus to the nerves of the stomach, whilst the Tartrate formed during its extrication gently moves the bowels. When the tartaric acid is saturated with the soda, the Tartrate crystallizes in fine needle-form crystals, soluble in their own weight of water. In this state the Tartrate is a mild purgative; but it is never prepared for this purpose. When extemporaneously prepared, it may be united with any of the aromatic bitters.

5. TARTARIZED SODA. *Sodæ Tartarizata.* L. *Sodæ Tartras et Potassæ.* E. D.—Soda Tartarizata of the London Pharmacopœia is a double salt, a *Tartrate of Soda* and *Potassa*, as it is correctly termed by the Edinburgh and Dublin Colleges. According to the formula for its preparation in these works, it is produced by saturating the excess of acid of the bitartrate of potassa with subcarbonate of soda, which is decomposed, and its soda combined with the tartaric acid; so that the acid in this case is united with two bases; or is, in fact, as I have already stated, a double salt.

The crystals of this salt are large, beautiful modifications of right rhombic prisms: they are generally produced in halves in the direction of their axis. Their taste is bitter and saline, but not disagreeably so; their solubility is considerable, five parts of water only, at 60°, being required for

this purpose. They are slightly efflorescent when exposed to the air. According to Vauquelin, the anhydrous salt consists of—tartrate of potassa 54, + tartrate of soda 46, in 100 parts; or the constituents may be thus stated—tartaric acid 62.60, + potassa 22.44, + soda 14.96, in 100 parts; or 2 prop. of tartaric acid $(66 \times 2) = 132$, 1 prop. potassa $= 47.15$, 1 prop. soda $= 31.3$, making the equivalent 210.18; or, taking in the water of crystallization of 1 prop. tartrate of potassa $= 113.15$, + 1 tartrate of soda $= 97.3$, + 8 water $(9 \times 8) = 72$, $= 282.18$.

This salt was first prepared and introduced as a purgative by M. Seignette, an apothecary of Rochelle, in 1672: thence the names Salt of Seignette and Rochelle Salt. The discoverer made a large fortune by keeping the preparation a secret; and it was not made public until 1731, when Boulduc and M. Geoffroy discovered its components, and read a paper on the subject to the Academy of Sciences of Paris. This salt was long a fashionable purgative, and was supposed to be fitted for all complaints; thence the name, *Sal Polychrest*, salt of many virtues. It was thrown out of favour for some cause, but is again restored to the votaries of the vacillating goddess, in the form of Seidletz powders, of which it forms the active basis.*

The dose of the Tartrate of Potassa and Soda is ℥ss. It may be administered in any vehicle that does not contain acids or acidulous salts. If any of the mineral acids be added in quantities sufficient to acidulate the solution of this salt, the Tartrate of Potassa is converted into the insoluble bitartrate. It is also necessary to avoid combining with this salt the acetates of lead, or the soluble salts of baryta and of lime.

All of these salts of soda operate moderately upon the whole length of the intestinal canal, stimulating the orifices of the exhalant vessels, and consequently producing serous

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* Dr. Paris informs us that the patent Seidletz powders consist of ʒii of Tartarized Soda and ℈ii of carbonate of soda in the white paper, and gr. xxxv of tartaric acid in the blue paper. The union of these form a bitartrate of soda, which, in conjunction with Tartrate of Soda and potassa, operates mildly and effectually on most persons; and, instead of being nauseous, is rather an agreeable dose.

evacuations, in the form of thin watery stools; and are therefore well calculated for all cases of febrile excitement, and those in which a plethoric state of the system requires to be reduced. Their influence on the exhalant vessels also promotes absorption; for these two systems sympathize so closely, that the action of the exhalants cannot be augmented without a corresponding increase of that of the absorbents.

In prescribing this range of purgatives, which are rarely given alone, unless as domestic medicines, it is of great importance to attend to the incompatibles, and also to the nature of the vehicles in which they are administered, to understand how far they tend to quicken or to retard their action. Thus the addition of sulphate of magnesia quickens the operation of infusion of senna; whilst, in weak habits that can scarcely bear the operation of purgatives, its combination with bitters and sulphuric acid sustains the strength, without impairing the purgative power of the salt; and, with the same view, sulphate of iron may be combined with this salt. Experience teaches us the advantage of attending to these combinations, many of which are of the utmost importance in a practical point of view.

6. Bisulphate of Potassa. *Potassa Bisulphas* is formed during the decomposition of nitrate of potassæ by sulphuric acid in the manufacture of nitric acid; the Bisulphate being the result of the combination of the sulphuric acid with the potassa of the nitrate. It remains in the retort, and requires to be dissolved in water and crystallized. If the solution be not sufficiently evaporated, the acid is separated from the salt, remains in the water, and neutral sulphate of Potassa is formed. If too little sulphuric acid have been used to decompose the nitrate, the salt, instead of being a Bisulphate, is a mixed salt, a sulphate of Potassa and a nitrate of Potassa. The Dublin College orders it to be prepared by the direct combination of its constituents; but this is an unnecessary and expensive process.

This salt differs both in its appearance and in its properties from the sulphate. It crystallizes irregularly, sometimes in slender, hexangular prisms, at other times in right rhombic prisms flattened so as to be tabular. It is extremely sour

and slightly bitter; it reddens vegetable blues, is soluble in two parts of water at 60°, and less than an equal weight at 212°. It effervesces with the alkaline carbonates. When exposed to a red heat, it is reduced to the state of the sulphate; the water of crystallization and the superabundant acid being both driven off. When exposed to a moderate heat, it melts and assumes the appearance of oil, but again becomes white on cooling. Its constituents are

Sulphuric Acid	54.80
Potassa	32.87
Water	12.33
	100.00

or 2 prop. Sulphuric Acid $(40 \times 2) = 80$, + 1 prop. Potassa $= 47.15$, + water $= (9 \times 2) = 18$, making the equivalent $=$ 145.15.

In prescribing this salt, it ought not to be united with any of the alkaline carbinates, nor with lime water. The carbonate of Potassa converts it into the neutral sulphate, that of soda or of ammonia form new salts with the excess of acid, whilst the lime water forms an insoluble salt, and decomposes the bisulphate. It may, however, be combined with sulphates of iron and of zinc, and with most of the vegetable purgatives, particularly with rhubarb, which, although it contain a salt of lime, yet, this being an oxalate, it is not affected by the excess of sulphuric acid in the bisulphate. It may also be advantageously prescribed with the sulphate of quinia, or that of morphia, if a purgative be required to be given in conjunction with these salts. In combination with rhubarb, it has been found useful in dyspeptic states of the habit, accompanied, as is usually the case, with torpid bowels. It is also a useful addition to aromatics and bitters. The dose is from gr. x to ʒii, three or four times a day.

7. Sulphate of Potassa. *Potassæ Sulphas.* L. E. D. —When Bisulphate of Potassa is dissolved in a large proportion of boiling water and subcarbonate of Potassa added, in sufficient quantity to saturate the superabundant acid, the result is a solution of Sulphate of Potassæ, which, on evaporation, yields the crystallized salt. Mr. Phillips suggests that it is preferable to saturate the excess of acid with lime, as the

sulphate is less valuble than the subcarbonate ordered to be employed by the London College; and this is the process of the Edinburgh College, which orders the carbonate of lime to saturate the superfluous acid of the *sal enixium*, as the Bisulphate is termed, and the sulphate of lime which is formed to be separated by the filter previous to the crystallization of the Sulphate of Potassa which is held in solution.

Besides these direct processes for the preparation of this salt, it is formed in several other processes, as, for example, in the preparation of the subcarbonate of magnesia. In the supernatant fluid, after the precipitation of the magnesia from the sulphate of magnesia, Sulphate of Potassa is held in solution, and can be obtained by evaporation.

Sulphate of Potassa, as it is usually prepared, is obtained in small, grouped, transparent crystals, the form of which varies according to the manner in which the crystallization is conducted; but one of the most common forms is a short hexædral, or six-sided prism, terminated with hexædral pyramids, forming a bypyramidal crystal. The primary form of the salt is a right rhombic prism. It has a bitter taste, suffers no alteration by exposure to the air; and, as it contains no water of crystallization, it merely decrepitates when thrown upon burning coals; but in a red heat it melts. It dissolves in sixteen times its weight of water at 60°, and in five parts of boiling water.

The composition of Sulphate of Potassa is differently stated by different chemists; that of Berzelius is

Sulphuric Acid	47.1
Potassa	52.9
	100.0

or 1 prop. of Sulphuric Acid = 40, and 1 prop. of Potassa = 47.15, making the equivalent = 87.15.

Sulphate of Potassa, in solution, is decomposed by tartaric acid, which forms crystals of bitartrate of Potassa; by muriate of barytes, and muriate of lime; but not by lime water. It is also decomposed by solutions of acetate and subacetate of lead, bichloride of mercury, and nitrate of silver; all of which might be ordered with it, but all of which are incompatible with it.

This salt has never, as far as my knowledge extends, been found in a state of nature, that is, as a mineral. I am aware that it is mentioned as a component in the water of Enghein, as analysed by M. Longchamp; but, in analyses of the same water by M. Fremy and the junior M. Henry, no mention is made of the Sulphate of Potassa. It has been procured from the ashes of plants by lixiviation, and is contained in urine and some other animal juices*.

The Sulphate of Potassa is a useful purgative; but, from its little solubility, it is seldom given alone, and scarcely ever in solution. It is supposed to extend its action beyond the bowels, and therefore is generally preferred as a purgative in cases of visceral obstructions; but I am inclined to believe that any effect of this nature is confined to the liver and the pancreas, and that it acts upon them by stimulating the orifices of their excretory ducts, in its passage through the duodenum. The dose for an adult is a drachm to three drachms. It is generally given in combination with jalap, rhubarb, aloes, or some resinous cathartic. In combination with aloes, as it acts on the duodenum, and the bitter of the aloes supplies the deficiency of bile, it is useful in jaundice, dyspeptic affections, and habitual costiveness in persons of sedentary habits†.

8. BITARTRATE OF POTASSA. *Potassæ Bitartras.* L. E. D.—In wine casks, during the slow fermentation which goes on in wine, a thick crust is deposited on the sides of the casks, tinged of a brown or reddish colour, according to the nature of the wine. This crust is familiarly termed argol, or crude tartar. It contains, besides the colouring matter of the wine, some extractive and tartrate of lime, and a large proportion of Bitartrate of Potassa. This bitartrate is also

* It was known at a very early period under a great variety of names, as, for instance, *Specificum purgans, nitrum fixum, arcanum duplicatum, panacea holsatica, sal Polychrest,* &c.: the present name, Sulphate of Potassa, was imposed by the French in 1787.

† The Duke of Holstein, as we are informed in Shaw's Life of Boyle, some time before 1663, purchased the secret of preparing this salt for 500 dollars, as a remedy in fever, stone, and scurvy. The term *Sal Polychrest,* which was applied to it as well as to the Tartrate of Potassa and soda, demonstrates the estimation in which these salts were held by the elder physicians. It is a good mechanical agent in assisting the pulverization of opium and some of the tough gum resins, which are apt to become soft under the action of the pestle.

contained in the pulp of some fruits. The usual process for purifying this impure salt is operose*; but it may be equally well effected by simply boiling it with recent powdered charcoal, according to the directions of Schaub.

The crystals of this purified salt are small, irregular, right rhombic prisms, with one of the sides striated. They have an acid taste, with a nauseous arriere-gout, feel gritty between the teeth, and, owing to this brittleness, are easily pulverized. The specific gravity is 1.953. They are so little soluble as to require sixty times their weight of water at 60°, and fourteen times their weight of boiling water, for their solution. The salt is not altered by exposure to the air; but its solution, when long kept, is decomposed, a mucous matter is deposited, and carbonate of Potassa, coloured with a little oil, remains in solution. This is owing to the decomposition of the acid, which consists of oxygen, hydrogen, and carbon; and of the water, the oxygen of which goes to form the carbonic acid which unites to the Potassa, whilst the abstraction of part of the carbon, and the addition of hydrogen to the original quantity, form the mucus.

The Bitartrate of Potassa of commerce is seldom pure, containing always more or less tartrate of lime. The constituents of the pure salt, according to Berzelius, are

Tartaric Acid	70.45
Potassa	24.80
Water	4.75
	100.00

or 2 prop. of Tartaric Acid $(66 \times 2) = 132$, 1 prop. Potassa $= 47.15$, 1 prop. water $= 9$, making the equivalent $=$ 188.15.

From the manner in which this salt crystallizes when procured in the large way, it has acquired the name of Crystals of Tartar†. It is a cooling purgative, operating on the whole length of the intestinal canal, but more especially stimulating

* London Dispensatory, art. Potassæ Bitartras.

† Paracelsus, the Prince of Empirics, as we are told by Van Helmont, in his Historia Vini Tartrate, says, that the name of *Tartar* is derived from its producing the oil, water, tincture, and salt, which burns the patient as hell does; and he affirmed that it is the principle of every disease and of every remedy—an opinion quite characteristic of its author.

the exhalants, producing watery stools, flatulence, and in many persons griping. Owing to its property of evacuating watery stools, it is a useful purgative in cases of ascites, and other dropsical accumulations; and, from its action being extended to the absorbents, its continued use is productive of emaciation; consequently, it is a good purgative in cases of plethora and obesity.

Owing to its insoluble character, it is generally given in the form of electuary, combined with jalap, or sulphur, or the electuary of senna. The addition of acid of one-fifth of borax, or one-ninth of boracic acid, to the Bitartrate of Potassa, increases greatly its solubility. It is incompatible with muriates of baryta and of lime. The dose is from gr. xv to ʒiii, twice or three times in the day.

9. TARTRATE OF POTASSA. *Potassæ Tartras.* L. E. D. —By adding as much of the Subcarbonate of Potassa to the solution of the Bitartrate of Potassa as will saturate the superabundant Tartaric Acid, this neutral Tartrate of Potassa is formed. It is also a product in making Tartaric Acid from the Bitartrate of Potassa.

This salt has a bitter, nauseous taste. Its specific gravity is 1.5567. It is generally in the form of powder; but it should always be crystallized; the form of its crystal is an irregular six-sided angled prism, with dihædral summits. It is soluble in its own weight of water, at 50° Faht. and still more soluble in hot water, whence its name *soluble Tartar.* It contains exactly half the proportion of acid which the Bitartrate contains. According to the analysis of Berzelius, it consists of

Tartaric Acid	58.69
Potassa	41.31
	100.00

or 1 prop. of Tartaric Acid = 66, + 1 prop. Potassa = 47.15, + 2 of water = 18, making the equivalent = 131.15.

In the usual granular form of the salt, it requires four times its weight of water for its solution; it also attracts water from the air. Like the Bitartrate, it is decomposed when kept in solution. When imperfectly prepared, it may con-

tain Bitartrate of Potassa, which is easily detected by litmus; or Subcarbonate of Potassa, which is made evident by turmeric paper. If any sulphate be combined with it, the muriate of baryta will throw down a precipitate insoluble in muriatic acid; whilst muriatic salts are detected by nitrate of silver throwing down a precipitate insoluble in nitric acid; but such adulterations rarely occur.

Tartrate of Potassa is decomposed by all the acids and acidulous fruits, which throw down insoluble crystals of the bitartrate. It is also decomposed by lime-water, muriate of lime and of magnesia, nitrate of silver, and the acetate and subacetate of Lead, which are consequently incompatible with it in prescriptions.

Tartrate of Potassa is a mild and efficient purgative, operating without griping: it has also the power of rendering other purgatives—as, for example, senna and scammony—less griping. Its influence is exerted on the whole of the intestinal canal; and it operates very quickly; it is also well adapted for cases of disease in which a quick and effective purgative is wanted. It is one of the most common purgatives given to carry off full doses of calomel through the bowels. Five or six grains of calomel are given at bed time; and next morning a draught, containing from ʒi to ʒii of Tartrate of Potassa in f℥iss of infusion of senna, is administered. This operates rapidly, and sweeps away the bile which the calomel brings down from the gall ducts. The usual dose of the Tartrate is from ʒi to ʒiv, mixed with infusion of senna or infusion of rhubarb, or any bland fluid.

10. Acetate of Potassa. *Potassæ Acetas.* L. E. D—Potassa has a powerful affinity for acetic acid; thence, when subcarbonate of potassa is added to diluted acetic acid, as ordered in the formula of the London Pharmacopœia, and aided by heat, the carbonic acid is driven off in the state of gas, and the solution being evaporated until a pellicle is formed, this salt, the Acetate of Potassa is procured. By the employment of acetic acid, instead of distilled vinegar, which was formerly used, the salt is now obtained of a pure white colour. In the large way, Acetate of Potassa is formed with the unpurified pyrolignous acid; it is therefore requisite to

blanch the foliaceous crystals by melting them in a gentle heat; adding animal charcoal; pouring over the cooled mass distilled water; adding some purified acetic acid; and again evaporating the fluid to obtain the foliaceous crystals.

Acetate of Potassa, when properly prepared, is in masses, having a foliated texture, white or colourless: it has a peculiar faint odour and a pungent, saline taste. It is extremely deliquescent when exposed to the atmosphere, and, consequently, very soluble in water. It is also very soluble in alcohol. It is decomposed by the strong mineral acids, which expel the acetic acid; the sulphates also decompose it. When the acetic acid which is employed in its formation is not free from lead or from copper, it gives precipitates with sulphuretted hydrogen, ferro cyanate of potassa, and tincture of galls; but with pure acetate of potassa none of these are formed. When exposed to a strong heat, Acetate of Potassa is decomposed and converted into subcarbonate of potassa; the hydrogen of the acid is expelled, and the carbon and oxgen uniting to form carbonic acid, this combines with the potassa and forms the subcarbonate.

Acetate of Patassa consists of—51 acetic acid, + 49 potassa in 100 parts; or 1 prop. acet. acid = 50, 1 p otassa = 47.15, making the equivalent 91.15.

In small doses this salt operates on the kidneys, or as a diuretic; but in larger doses, that is, from ʒii to ʒiv, it is purgative. In administering it for purgative purposes, the surface of the body should be kept warm. It is, upon the whole, an indifferent purgative, and ill calculated to set aside any that has been previously described. It is incompatible in prescriptions with sulphate of soda and of magnesia, corrosive sublimate, and nitrate of silver, besides the other substances already stated.

The salts of potassa, like those of soda, operate by producing large serous evacuations; and, therefore, they form powerful agents in the antiphlogistic or depleting plan of treatment, as it is termed. In cases which require the habit to be brought down rapidly, the tartrates are preferable to the sulphates or to the Acetate; but, regarding the salts of potassa as general purgative agents in the cases for which salts of

soda are peculiarly indicated, I have no hesitation in adjudging the superiority to those of soda. We must always recollect that the efficacy of all medicines depend on the discrimination and judgment with which they are administered.

d. DRASTIC CATHARTICS.

Drastic Cathartics are medicines which operate by powerfully stimulating the intestinal canal, affecting both the nerves of sensation and of motion. They consist chiefly of organic products, containing some very active principle, generally involved in substances that, from their inertness, seem intended rather to obtund its energy than to aid its cathartic properties. Their operation is usually attended with griping; and, in many instances, the effects are so violent, that, unless their operation be closely watched, much mischief may result from their employment. They exert a very powerful influence on the exhalants and the absorbents, and merit the term *Hydragogues* more than any other set of purgatives: indeed, when the powers of the system are capable of bearing up against the debility which they produce, there is no set of remedies so much to be relied upon in the treatment of dropsical affections, unconnected with organic disease.

ORGANIC PRODUCTS OPERATING AS DRASTIC CATHARTICS.

a. COLOCYNTH. *Pulpa Colocynthidis.* L. E. D.—Colocynth is brought to this country from the Levant. It is the fruit of the Cucumis *Colocynthis*, an annual plant which grows in great abundance in Turkey and Nubia, and is cultivated in Europe, although it never attains to perfection, even in the south of France. The Colocynth, or Bitter Cucumber, as it is termed, from its similarity in the herbaceous part of the plant to that of the Cucumber, belongs to the natural order Cucurbitaceæ*. The fruit of this plant is a globular berry or pepo, to use the language of Botany. It is about the size of a small orange, smooth on the outside, trilocular, each cell containing many ovate, compressed, whitish seeds, enclosed in a white, spongy, membranous substance. It is seldom

* Woodville's Med. Bot. 3rd edition, p. 189, pl. 71. London Dispensatory, art. Cucumis.

imported into this country with the outer coat on, but is brought in the peeled state, having been dried in a stove, which converts the pulp into a white, easily torn, papery-looking matter. In this state, it is commonly called the *Coloquintida Apple.*

The dried Colocynth is inodorous; the white spongy part, which is that employed in medicine, is intensely bitter and nauseous. When this spongy body is macerated in alcohol, it yields its bitterness and communicates a yellow colour to the spirit: and, when this is evaporated, it leaves a resinous substance, which Vauquelin, who first obtained it, regards as the active principle of the drug, and named it *Colocyntine**. It differs from resin in being partially soluble in water, so that the alcoholic tincture is not decomposed when poured into water. It resembles the bitter principle obtained from other plants; but differs from it in some respects: thus, it resembles this principle in not being affected by the reagents which usually affect vegetable bodies. The sulphates of iron coagulate the aqueous infusion, as does also the acetate and subacetate of lead; but nitrate of silver produces no effect upon it. The spongy mass swells and becomes diaphanous, resembling the appearance, in some degree, of tragacanth, when soaked in water; but it is not soluble in either water or alcohol: I am inclined to consider it a modification of Cerasin. Ether, when digested on the pulp, takes up both the resin and the bitter extractive: when evaporated on water, it leaves a pellicle of the former, white and opaque, whilst it communicates an intense bitterness to the fluïd. The results obtained from the chemical examinations of Colocynth hitherto made, are by no means satisfactory, and cannot be regarded as elucidating the nature of its purgative principle.

Colocynth was well known to the ancients as a Drastic Cathartic, which required to be cautiously administered: they employed it chiefly in dropsical and lethargic affections. The watery decoction or infusion is much less violent in its effects than the alcoholic. On account of its extreme bitterness, however, Colocynth is usually given in the form of extract, made into pills. Its drastic qualities are much mitigated by com-

* Journ. de Pharm. tome x, p. 416.

bining it with camphor and hyosciamus. From the experiments of Orfila, Colocynth appears to exert its influence chiefly on the rectum, which, in dogs killed by taking it, was always found inflamed; and this occurred even when the Colocynth was applied to a wound on the thigh, instead of being taken into the stomach. When taken into the stomach, even in moderate doses, it gripes violently whilst it purges; in large doses, it occasions bloody stools and inflammation of the colon. Several instances of fatal effects from its use are recorded by Continental practitioners, and Dr. Christison quotes a case from the Courier newspaper, in 1823, of an inquest held on the body of a woman who died in twenty-four hours, with incessant vomiting and purging, in consequence of having swallowed, by mistake, a tea-spoonful and a half of powdered Colocynth. Dr. Fordyce mentions the case of a woman who was subject to colics for thirty years, in consequence of only once taking an infusion of the pulp of Colocynth prepared with beer. When given in substance, the dose is from four to ten grains; but it is necessary to obtund its operation by triturating it with gum, or some other farinaceous matter. Notwithstanding its violence, Colocynth is a Cathartic in daily use. It may be given in combination with almonds or mucilage of gum; but, independent of its drastic properties, when given alone, the difficulty of reducing it to powder is a sufficient reason for seldom giving it in substance. The aqueous decoction is milder in its effects than either the powder or the extract, and has been occasionally given in worm cases. Colocynth is, nevertheless, a Cathartic in very general use, and, under proper management, it answers every indication for which it is prescribed.

b. SCAMMONY. *Scammonii Gummi resina*. L. E. D.— Scammony is the product of the Convolvulus *Scammonia**, a plant belonging to the natural order Convolvulaceæ: is a native of Syria, growing in abundance on the mountains between Aleppo and Latachea. The best Scammony is brought from Aleppo.

Scammony is the concreted juice of the root of the Con-

* Woodville's Med. Bot. 3rd edit. p. 213, pl. 86. London Dispensatory, art. Convolvulus.

volvulus *Scammonia*. In the month of June, the roots which have attained to the diameter of three or four inches are cut across in a sloping direction, the earth having been first cleared away from them. The incision is made about two inches below the place where the stalks spring; and a shell being placed at the lowest part of the incision, the milky juice which issues is collected in it. A root yields a few drachms only; the different collections from a vast number of roots are put indiscriminately together, so that every kind of Scammony is found in the same package. The Jews of Aleppo, who are the agents between the collectors of the Scammony and the exporters, mix the soft Scammony with sand, ashes, and various impurities, to give it weight; on which account, the drums or packages of the drug, which generally weigh from 75 to 125 pounds each, do not contain more than from 50 to 65 pounds of pure Scammony. Smyrna Scammony is the next in point of quality: but it is often an artificial compound of jalap, senna, camboge, and ivory-black. Scammony is sometimes adulterated with the juice of the Cynanchum *Monspeliacum*.

Good Aleppo Scammony is light, friable, breaking with a regular, smooth, faintly shining fracture. Its odour is peculiar, not unlike that of old ewe-milk cheese; and the stronger this odour is, the better is the Scammony: its taste is bitterish and slightly acrid. The colour is a blackish or dark-grey, and, if good, it lathers or turns to a dirty white when it is rubbed with a moist finger. When Scammony is triturated with water, it forms a milky or emulsive solution, which lets fall, on standing, a portion of insoluble resin. This solution of Scammony is altered by alcohol, and by some of the solutions of the metallic salts, especially subacetate of lead: when liq. potassæ is dropped into it, a yellow precipitate is formed, which is quickly dissolved on the addition of an acid: it is probably a compound of extractive and potassa, which is insoluble in water. The gum remains in solution with the alkali; and if the solution be strong, it is precipitated by alcohol. Alcohol takes up six-tenths of the Scammony, which is pure resin, and may be precipitated from the alcoholic solution by means of water. According to the analysis

of Vogel and Bouillon La Grange, Scammony is composed of—

	Aleppo.	Smyrna.
Resin	.60	29
Gum	.03	8
Extractive	.02	5
Waste	.35	50
	100	100

It is said that the root of the plant, when it has been drained of the milky juice in the manner I have described, is still Cathartic; which probably arises from some of the juice being left, and concreting in the vessels of the root.

Scammony is a powerful Drastic Cathartic, very apt to gripe when given alone. Its purgative principle resides in the resin, which is too drastic when separated from the gum and extractive. The ancients are said to have employed Scammony as an external application to tumours, itch, scurf, and fixed pains; which is rather surprising, as Scammony purges almost as freely when rubbed upon the skin as when taken into the stomach. The acrimony of Scammony as a purgative was so constantly kept in view by the ancients, that they invented a variety of methods of correcting it; and they termed the compounds Diagrydia. Scammony is usually given in combination with calomel; and it is one of those substances that sulphate of potassa aids greatly in its effects, whilst, at the same time, it modifies its griping quality. I have found it an excellent occasional Cathartic in leucophlegmatic and hypochondriacal cases; and for removing the scybala that frequently lie for a long time in the colon in maniacal cases. In dropsical diseases, in which there is often a torpid state of the bowels, Scammony, in combination with bitartrate of potassa, aids greatly in removing accumulations of serous fluids from internal cavities when the dropsy is not of an encysted kind. It is also one of the best Cathartics, combined with calomel and sulphate of potassa, in worm cases.

The dose of Scammony in substance, is gr. v to gr. xv. When administered, either alone or in combination, it should be conjoined with a drop or two of some volatile oil. The

watery infusion is sufficiently active, and does not gripe so violently as the medicine in substance, owing to the precipitation of the resinous part. When given in an overdose, the case must be treated as one of common inflammation of the bowels.

c. CAMBOGE. *Cambogia.* L. E. D. — There are various plants, both trees and herbs, which secrete a yellow juice, which thickens in the air, and has something of the appearance of Camboge; but it remains soft and tenaceous, whilst the true Camboge is hard and friable*. The name of this drug is derived from Kamboja, a river in Siam, on the banks of which the tree, the Staligmitis *Cambogioides*, the proper juice of which it is, grows in great abundance. This tree belongs to the natural order *Guttiferæ*†. This tree, as it is found at Siam, and in the island of Ceylon, and in China, is of a moderate height, with a tufted head, from the foliage appearing only at the summits of the branches. The leaves are on short petioles, ovate, opposite, entire, even, rigid, of a deep green colour, and exuding, when they are bruised or in any manner lacerated, a bright yellow juice, which also exudes in drops that concrete upon the bark.

In Siam, the Camboge is procured from the leaves by merely breaking them, and allowing the proper juice to distil into cocoa nut shells, in which it is left to harden; and, when sufficiently firm, is formed into rolls and wrapped up in leaves. In Ceylon it is collected by wounding the tree and striking the trunk as the juice flows. The juice, after hardening, is transferred into cases and boxes, in which state it is brought to Europe.

Camboge is in solid masses, of a deep orange colour, which break with a vitreous fracture, are brittle, easily pulverized; when heated, melt, and burn in a strong heat with a white flame, leaving a light, spongy charcoal, which con-

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* Some species of Hyperiium, the Chelcdonium *majus* and *minor* which grow in this country, and some other exotics, as I have already stated, yield yellow, proper juices; but these juices differ in their chemical properties from Camboge, and have not been employed in medicine.

† Woodville's Med. Bot. 3rd edit. p. 78, pl. 23. London Dispensatory, art. Cambogia.

tains carbonate, phosphate, and hydro-chlorate of Potassa, and carbonate and phosphate of lime. Camboge has no odour, and scarcely any taste ; but, after being masticated, it imparts a sensation of acrimony and dryness to the mouth. When triturated with water, it forms a turbid, bright yellow solution, which reddens slightly the tincture of litmus ; is rendered transparent by the addition of alcohol, and is not affected by the solutions of any of the metallic salts ; but is rendered nearly white when agitated in a bottle of chlorine. Alcohol dissolves nine parts in ten of Camboge, forming a deep orange tincture, which, when diluted with water, does not throw down the resin, although it produces a uniform milky fluid, and, when evaporated, yields it perfectly free from gum. Ether dissolves it more freely, and, when evaporated on water, leaves a pellicle of very pure, semi-transparent resin. The proportion of resin exceeds three-fourths of the Camboge submitted to the action of these agents. It is of a red colour, insipid, and possessing an idio-electric property. In the entire state, it is inodorous ; but, when pulverized, exhales a peculiar odour. When it is acted upon by Liquor Potassæ, a deep red oily solution is formed, which crystallizes when it is evaporated ; and, when acids are poured into the solution, yields a coagulum of a beautiful yellow colour. What remains, after the action of alcohol or ether, is nearly altogether soluble in water, and, when evaporated, yields a semi-transparent gummy substance, which Braconot regarded as ceracin, but which differs from it in being completely soluble in water. Lime water, added to the savonule of the resin, deposites a beautiful orange-coloured precipitate : sulphate of iron is precipitated brown, and nitrate of copper green. When Camboge is carefully analysed, it is found to consist of eighty parts of this resin and twenty of the gummy matter in 100 parts. With alkalies, Camboge, like the resin, yields a deep brown solution, which is precipitated by acids. The resin, when acted upon by nitric acid, is converted into a yellow bitter principle. These experiments explain the chemical properties of Camboge, proving it to be a simple gum-resin, but throw no light on its purgative principle.

As a medicine, it is a powerful, drastic Cathartic, exciting

vomiting when given alone, even in moderate doses. It is usually combined with calomel, soap, or rhubarb, to obtain its aid as a purgative, in doses of from gr. ii to gr. vi; and with squills, Bitartrate of Patassa, Sulphate of Potassa, and nitre, for hydragogue purposes. The alkaline solution, in doses of from thirty to fifty minims in a sufficient quantity of water, twice or thrice a day, is also employed in dropsical affections. It operates both on the bowels and the kidneys, through the latter of which it passes unaltered, and may be detected in the urine.

Camboge was long regarded as a powerful vermifuge in cases of tape worm; but, since the introduction of oil of turpentine for the expulsion of tænia, the use of Camboge for this purpose has been discontinued. It is more employed as a pigment than as an article of the Materia Medica.

5. BUCKTHORN. *Rhamnus Catharticus. Baccæ succus.* L. E. D.—The Rhamnus *catharticus* belongs to the natural order Rhamneæ, of which it forms the type*. The fruit, which is the part used, is a globular fleshy berry, with from two to four fibrous, indihescent seeds. The recent juice, when combined with alumina and lime, forms the pigment called sap green. The juice of the Buckthorn berries is naturally of a green colour, but is reddened by acids and again restored by alkalies; so that it is sometimes employed as a reagent to detect the presence of these substances. The aqueous infusion is blackened by the persulphate of iron.

Buckthorn, when employed as a Cathartic, operates violently, causing griping and a sensation of dryness in the throat. It was formerly much used as a hydragogue purgative; but the violence of the griping which it causes has produced an almost entire ejectment of Buckthorn from the Materia Medica. The interior bark of the young branches is said to purge as violently as the berries. A syrup made with the juice of the berries, fermented and clarified, is much used on the Continent.

Twenty of the recent berries purge briskly, and the peasantry employ them for this purpose: but the most common

* Woodville's Med. Bot. 3rd edit. pl. 210, p. 595. London Dispensatory, art. Rhamnus.

form of the medicine is the syrup. Whatever form it may be administered in, Buckthorn is a medicine of too drastic a nature to be much employed; yet it was the favourite purgative of Sydenham; and it is alleged that much of his success in the early part of his career is attributable to his frequent employment of this Cathartic. When it is taken, the patient should dilute freely with some bland mucilaginous fluid. The dose of the syrup is f℥i to f℥iii.

Hedge Hyssop. *Gratiola Officinalis.* L. E. D.—This plant is not an indigenous plant, although cultivated in this country, but is a native of the south of Europe. It belongs to the natural order Labiatæ*. It is a perennial plant. It rises with a straight herbaceous stem, a little branched, and furnished with opposite semi-amplexicaule, ovalo-lanceolate, smooth, slightly-toothed leaves. The flowers are solitary, pedunculated, each accompanied with two lanceolate bractes, larger than the calyx. The calyx is divided into five segments, a little unequal. The corolla is a tube, terminated by four segments, which form two lips, the uppermost broad and reflected, the inferior consisting of three divisions. Although it has four filaments, yet there are two anthers only, which fixes the plant in this class. The germen is ovate, surmounted by a style supporting a hollow stigma. The seed-vessel is a smooth, two-celled capsule. The plant delights in a moist situation, and flowers in June and July, at which time it should be gathered for medical use, being then in its best state.

Gratiola is nearly inodorous; the taste is bitter and nauseous; and it yields its sensible properties both to alcohol and water, but chiefly to the latter. The colour of the infusion resembles that of Sherry or Madeira wine: it is erroneously said to be slightly acidulous; it strikes an olive colour with sulphate of iron, without any precipitation. Vauquelin analysed this plant, and obtained a gummy matter of a brown colour; a very bitter resinous matter, soluble both in alcohol and water; malate and phosphate of lime; and another cal-

* Woodville's Med. Bot. 3rd edit. pl. 131, p. 360. London Dispensatory, art. Gratiola.

careous salt combined with a vegetable acid, not yet known; silex, and woody matter. Vauquelin supposes that the active principle resides in the resinous extract.

Gratiola is a powerful drastic Cathartic, and is much employed by the peasantry; thence, it is commonly called, in France, Herbe à pauvre homme; and its name derived from Gratia Dei, may have a similar origin. The root is seldom used, as it excites violent vomiting; and indeed the whole plant is poisonous in large doses, operating exactly in the same manner as the acrid, irritating poisons. From the experiments of Orfila, it appears to produce inflammation in the stomach, and throughout the whole intestinal canal, but chiefly in the rectum. He conceives that it is not absorbed, but acts directly on the nervous system. The German physicians, Hufeland in particular, think that it is extremely efficacious in visceral obstructions—jaundice, for example—and in ascarides: a circumstance that is likely to be the case, from its operating on the rectum. From its griping qualities, it is usually combined with aromatics. When given in the form of powder, the dose is fifteen grains; and in that of the infusion, made with ʒii of the herb in oss of boiling water, from fʒiv to f℥i.

Gratiola is not contained in the list of the Materia Medica of the London College; and, if we consider that its drastic and poisonous properties are not counterbalanced by other useful qualities, we must admit that it should be altogether banished from the Materia Medica.

b. OLEO-RESINS.

The Resin in these compounds is combined with volatile oil instead of extractive; and it is doubtful whether the activity of the substances depends on the resin or the essential oil. We find both of these components so modified in different plants, as to operate with considerable energy upon the intestinal canal; and perhaps in every instance, in which a resin can be demonstrated to be the active ingredient in a vegetable purgative, we might be able to detect a volatile or an acrid fixed oil in combination with it. The only drastic

Cathartic containing it is the root of a plant which has been long known in our gardens as one of the earliest harbingers of spring, generally appearing about the end of January.

HELLEBORE. *Hellebori Nigri Radix.* L. E. D.—Black Hellebore belongs to the natural order Ranunculaceæ *. The root of the plant is composed of thick, fleshy fibres, of a dark colour. The plant is familiarly called Christmas Rose, owing to its flowering occasionally at Christmas; but more generally it does not flower until the end of January, or even until the commencement of February.

The Greeks had two names for this plant, Elleboros and *Melampodion.* The first derived its origin from the poisonous nature of the plant, *elein* signifying to *destroy*, and *bora*, nourishment. The other appellation, *Melampodion*, was adopted from Melampus, the son of Amythaon, who cured the daughters of Prœtus, King of Argos, of melancholy, by purging them with Hellebore. He had remarked that the goats who fed on this plant were purged; and having given it to these young princesses, who were wandering in the woods, fancying themselves cows, he cured them, and received the hand of one of them in marriage, and a part of the kingdom of Argos as his fee. The various authors, both ancient and modern, who have mentioned this fable on tradition, have differed greatly with respect to the actual plant which was employed; and, consequently, it is still doubted whether the Black Hellebore is the real Hellebore of the ancients. Theophrastus and Dioscorides mention both white and black Hellebore, *Elleboros leucos* and *Elleboros melas.* Botanists have agreed that the former is the Veratrum *album* of Linnæus, a plant which I have already described, and which is very different indeed from the modern Hellebores, the family to which our present plant belongs. Tournefort, in a voyage to the Levant and into Greece, and Lamarck, have regarded the Black Hellebore of the ancients to be the Helleborus *orientalis* of Linnæus; and, if the writings of those ancient poets who have described the place of growth of the plant be credited, these opinions of the French naturalists are confirmed. But

* Woodville's Med. Bot. 3d edit. p. 463, pl. 169. London Dispensatory, art. Helleborus.

although our Black Hellebore is certainly not the celebrated plant of Anticyra, where it does not grow, yet this plant, the Hellebore of our Pharmacopœias, possesses both similar chemical and medicinal properties. In the dry state, the root of Black Hellebore, is exteriorly of a deep brown, sprinkled with grey; its interior is fleshy, not fibrous; its lateral fibres are fragile. Its infusion made with water at 60° has a yellow vinous colour, and is precipitated by tincture of galls; subacetate of lead also throws down a slight precipitate; and sulphate of iron strikes a black colour with this infusion.

The taste of the roots of Hellebore is bitter and acrid, leaving an impression of burning upon the tongue. This acrimony is in a certain degree volatile; at least the acrimony of the plant is impaired by keeping; and when the root is distilled with water, the fluid which comes over is acrid. The virtues of Hellebore, however, seem to depend upon a concrete fixed oil, which is taken up by boiling alcohol; and which may be separated by digesting the root in alcohol, and distilling off the spirit from the tincture: the oil gradually separates and concretes on cooling. When dissolved in weak alcohol, it precipitates the sulphate of iron. Monsieur Feneulle and M. Capron have analysed Black Hellebore, and state its constituents to be—1, a volatile oil; 2, a concrete oil; 3, a resinous matter; 4, wax; 5, a volatile acid; 6, a bitter principle; 7, mucus; 8, alumina; 9, gallate of potassa and of lime; and 10, ammoniacal salt.

The gallates are rendered evident by the colour which the aqueous solution of the root strikes with sulphate of iron, whilst no precipitate being produced by gelatin demonstrates the absence of tannin. The mucus is rendered obvious by the subacetate of lead.

As a purgative, Hellebore was one of the chief resources of the ancients: Hippocrates extols its virtues, and Galen regards it as the most valuable of all purgatives; but, even at that early period, the violence of Hellebore was so well known as to require the greatest caution in its administration. Perseus attacks the physicians of his time for not knowing the method of moderating the action of Hellebore. The ancients employed their Hellebore in many diseases; but it

was chiefly celebrated for its effects in insanity ; so much so, that the proverb " send him to Anticyra," the place where the plant was collected, was equivalent to a declaration of his madness. Ovid, in one of his epistles, has a beautiful allusion to this circumstance : he writes

> " Littus ad Euxinum, si quis mihi diceret, ibis,
> Et metues, arcu ne feriare Getæ ;
> I, bibe, dixissem purgantes pectora succos
> Quidquid et in tota nascitur Anticyra."

The importance of the employment of active purgation in insanity cannot be doubted ; and, as the chief object is to dislodge irritating *scybala*, the advantage desired must undoubtedly depend greatly on the activity of the Cathartic. Whether Black Hellebore be the best purgative in such a case, my experience does not enable me to determine ; but there can be only one opinion regarding the employment of any purgative capable of effectually clearing out the bowels. So long as the fæces consist of dark, broken-down matters, accompanied with scybala, the use of active Cathartics is indicated. I may, however, take this opportunity of pointing out the necessity of not carrying the purging too far, and the practical importance of knowing when to desist. If the fæces change in aspect and appearance, become moderately consistent, are more natural in colour and well tinged with florid bile ; if, at the same time, there be a remission of symptoms, and a freedom from pain on compressing the liver ; and, particularly, if there be some reason to suspect the approach of debility ; then it is time to discontinue the purging and support the strength of the constitution by nourishment.

With regard to the ancient use of Hellebore as a hydragogue, there can be no doubt that Black Hellebore, in common with some other Cathartics of the division of the order to which it belongs, produce copious evacuations both by stool and urine ; and hence it is well fitted to carry off dropsical accumulations. The pills of Bacher, that at one time held a high reputation for the cure of dropsy, contain an extract of Black Hellebore. They are now rarely employed ; and indeed, except with the view of exciting the uterine organs, this Hellebore is scarcely ever prescribed. The dose

of the Hellebore root, in substance, is from gr. x to ℈i, or of the decoction f℥i may be given once in four or five hours, which is a safer method of administering it than giving a full dose at once. When it is overdosed, the usual effects are vomiting, with delirium and violent convulsions; and the morbid appearance after death display signs of inflammation in the alimentary canal, particularly in the large intestines, the colon, and rectum. A gorged state of the lungs, and a brownish-black, or gangrenous appearance of the stomach, have also been observed. I know of no particular antidote for Black Hellebore; and, therefore, when it poisons, the case must be treated as one of simple inflammation of the digestive organs and the mucous membrane of the intestines.

c. FIXED ACRID OIL.

In the substances arranged under this head, the fixed oil is the mere vehicle of the acrid principle, which is the cathartic agent. Of the real nature of this principle we know little, except as respects its influence on the habit.

1. Oil of Croton. *Tiglii Oleum.* L. D.—The Croton *Tiglium*, a plant which is a native of Ceylon, the Molucca islands, Cochin China, and the greater part of the East: it furnishes one of the most violent of the Drastic Cathartics. It belongs to the class of the Linnean system *Monœcia*, and the order *Monodelphia*; and to the natural order *Euphorbiaceæ**. The fruit, the part of this tree which yields the oil, like the rest of the natural order to which it belongs, is tricoccus, with thin, almost membranous partitions between the cells, each of which contains one seed.

The drastic properties of this plant are diffused over it, being found in the roots, the wood, the leaves, and particularly in the seeds.

The root is employed in Amboyna and Batavia as a hydragogue Cathartic in dropsy. In the same places, the wood, which is light, spongy, pale, and covered with an ash-coloured bark, which has a caustic, pungent taste, and an unpleasant odour, is regarded as a *panacea*†. It is more active in the

* Woodville's Med. Bot. 3rd edition, vol. v, p. 71.

† Rhumphius recommends an infusion of the shavings as an infallible remedy in dropsy.

recent than in the dried state, exciting sweating in the small, and purging in large doses. Murray states that the leaves are so acrid that they inflame the lips, mouth, and fauces, and the heat induced by tasting them extends to the anus. The seeds were employed in medicine, in Europe, at a very early period, under the name of *Molucca grains*, Grana Tiglia: but the imprudent use of them*, in some cases, caused them to be neglected, until the introduction of their expressed oil, a few years since, by Mr. Conway, a surgeon in the Madras establishment, again brought them into notice. In India the seeds are still employed; but their acrimony is diminished by roasting, which is done with the view of rendering them more easily pulverized.

The expressed oil of these seeds, which is the only product of the plant noticed in the British Pharmacopœias, is of a bright straw, or citrine-yellow colour; has a faint odour, and a hot, extremely acrid taste, which remains long upon the palate and fauces, producing a burning sensation, with a feeling of constriction in these parts.

Dr. Nimmo of Glasgow has examined both the seeds and the oil chemically. He found that the active principle resides in the kernel of the seed; for although the husks or shells imparted a dark colour to alcohol, yet the tincture was devoid of acrimony. The kernels being beaten to a paste, and digested for several days in alcohol, with a moderate heat, and this digestion repeated with fresh alcohol, eleven parts in forty of the kernels were taken up by the spirit, and the residuum was tasteless, although it evidently contained a fixed oil, which greased the paper in which it was dried.

To ascertain the quantity of the acrid principle, Dr. Nimmo purified some oil of turpentine by means of alcohol, agitating the two together, in the proportion of eight parts of the oil to one of the strongest alcohol, and decanting off the impurities with the alcohol, which dissolves them; and repeating this operation three or four times. This purified oil of turpentine was poured upon the residue of the Tiglium seeds after they had been acted upon by the alcohol; and after digesting for a considerable time, it was found that

* Geoffrey limits the use of the oil to one drachm!

thirteen of the twenty-nine parts were by these means dissolved: and this being the fixed oil, it appeared that 100 parts of the decorticated seeds contained 27.5 of acrid matter, soluble in alcohol; 32.5 fixed oil, soluble in oil of turpentine; and 40 of farinaceous matter: and such may be regarded as the constituents of the seed. The expressed oil itself consists of 45 of this acrid principle and 55 of fixed oil in 100 parts of the ordinary expressed oil. The alcoholic solution reddened tincture of litmus when dropped into a solution of this colouring matter: it rendered water nebulous when dropped into it; and, when filtered, the clear water which passed the filter was found to be perfectly inert. From these experiments, Dr. Nimmo justly concludes that the acrid principle of these seeds, and consequently of the oil procured by expression, resides in a resinous principle, which is soluble in alcohol, sulphuric ether, and volatile and fixed oils.

When strong alcohol is digested on the oil of Tiglium, and the operation repeated several times, about a third part of the oil is taken up, and this solution has all the properties of the unsophisticated oil; whilst the undissolved oil which remains is perfectly inert.

The Oil of Tiglium, from its high price, is frequently adulterated with olive or castor oil; to detect this, Dr. Nimmo recommends the following simple process. Put into a phial, the weight of which has been previously ascertained, fifty grains of the oil, add alcohol which has been digested upon olive oil, agitate well, and pour off the solution, and add more oil, repeatedly, in the same manner. On placing the phial near the fire, to evaporate any remaining alcohol after the alcoholic solution has been decanted off, and weighing the phial with the residue; if we find that it is in proportion to that which has been abstracted by the alcohol, as fifty-five to forty-five, the oil is genuine; but if the residue be greater, it implies that the oil has been adulterated with olive oil: if smaller, then we may conjecture that it is mixed with castor oil. Dr. Paris has suggested the idea that the alcoholic solution which Dr. Nimmo obtained, contains a principle, *sui generis*, which he proposes to call Tiglin; but perhaps this proposition is rather premature.

Croton, or more correctly speaking, Tiglium oil, operates exactly in the same manner as other drastic purgatives, except that the quantity requisite is extremely small; and it operates even by the application of it to the tongue. Notwithstanding its violent cathartic operation, yet it seldom excites nausea or vomiting, and scarcely ever griping: and this is particularly the case when the alcoholic solution is employed. It may be administered in all cases where a quick and ample operation is required; in maniacal cases, and in cases of visceral obstructions, and dropsical accumulations. Dr. Nimmo remarks, that he has found this oil, or its alcoholic solution, in combination with opium, extremely beneficial in delirium tremens, a disease which arises generally from intemperance in the use of ardent spirits. In apoplexy I have been enabled to prove the utility of this oil; and have produced free evacuations by merely touching the tongue with the oil, after the faculty of deglutition was altogether suspended; for the same reason, it is extremely useful in maniacal cases, when there is a difficulty of getting the patient to swallow more bulky medicines.

Experience has amply justified the propriety of again introducing the use of the Oil of Tiglium into practice; and, with due caution, it is both a safe and not unmanageable medicine. The most common form of giving the oil, is that of pill, formed by dropping the oil on crumb of bread; one or two drops proving a sufficient dose. Or it may be given with rhubarb, which readily absorbs the oil, and can be easily formed with a little water into pills. The purgative property of the rhubarb is scarcely felt in such small doses. This mode, however, of administering the oil has one disadvantage; namely, it is applied in too concentrated a state to the portion of the stomach on which it rests. I have found that the taste and acrimony of the medicine are well covered by triturating the oil with mucilage and syrup of tolu, and diffusing it through the common almond emulsion.

A tincture of the seeds, made by digesting gr. 170 of the decorticated kernels powdered in one pound of proof spirit for fourteen days, and then filtered, may be substituted for the oil. The dose is from m. 40 to m. 100.

Mr. Morson, of Southampton Row, Russel Square, has lately manufactured this oil into soap, for internal use, to be given in the form of pills. He asserts that the combination of oil with the alkali diminishes its acrimony, but does not lesson its cathartic powers. I can neither affirm nor deny this assertion from my own experience. The dose of the soap is from one to three grains: but no form of administering this powerful Cathartic is so good as that of solution in alcohol, as proposed by Dr. Nimmo.

2. Oil of Spurge. *Euphorbiæ lathyris Oleum.*— The species of Euphorbium which yields this oil is a herbaceous plant, a biennial, common to many parts of Europe, belonging to the natural order Euphorbiaceæ. It is a powerful excitant, and when taken into the stomach operates as a powerful Drastic Cathartic. In France, the fresh fruit of this species of spurge is in common use with the peasantry as a purgative; but at the same time it operates also as an emetic, and the vomiting it induces is maintained for several days. If the dried seeds, decorticated, be swallowed, however, their purgative influence only is exerted in a mild manner.

In 1823, M. Barbier suggested the propriety of trying the influence of the expressed oil of these seeds as a purgative. This oil is white, transparent, having scarcely any odour, and a mild taste: like castor oil, it is soluble in alcohol. It readily becomes rancid and loses its transparency. The oil may be procured by expression; or the active principle may be separated by digestion in alcohol at 30° Beaumè, or in ether. Many experiments have been made with it in France, and these have fully demonstrated its purgative properties. From twenty to thirty minims of the expressed oil purge freely, without exciting griping; it does not heat the habit, nor cause thirst, nor affect the appetite: it operates briskly, but it does not produce that impression on the mucous membrane of the intestinal canal which plays the part of a counter-irritant; it is, therefore, inferior in many respects to oil of Tiglium, and many others of this division of Cathartics. It is, consequently, well adapted for clearing the alimentary canal in weak and nervous subjects, and in those in whom visceral irritation becomes a strong source of general discomfort, and who cannot

sustain the influence of ordinary Drastic Cathartics, whilst at the same time they need the aid of an active one. The Oil of Spurge may be administered in combination with any of the other purgatives, especially rhubarb, which, from its tonic influence, is well adapted to supply tone to those habits for which it is especially indicated.

d. NICOTINA.

The existence of this principle in the leaves of Tobacco has been several times mentioned. It operates powerfully upon the intestinal canal, whether it be administered internally or merely applied to the surface. The infusion of Tobacco, which contains it, has been employed in dropsical complaints, internally; but it operates as a diuretic: it is not administered by the mouth as a purgative, although it be exhibited as a glyster in those cases which require spasm to be resolved at the same time that the bowels are to be opened. With this view, it is frequently ordered as a glyster; but the remarks which may be offered respecting its effects in this form, must be reserved until the subject of Enemas come to be discussed.

e. VERATRIA.

The chemical nature of this principle has been already explained (vol. i, p. 595). As a Cathartic, its chief influence is exerted upon the orifices of the common gall duct in the duodenum; thence a copious discharge of bile takes place, and the action of the intestinal canal is greatly augmented. It is the active principle of two Drastic Cathartics, Veratrum *album* and Colchicum *officinale*.

1. ROOT OF WHITE HELLEBORE. *Veratri albi Radix*. L. E. D.—This root is a native of the Alps, Auvergne, Provence, and Dauphiny. Although perennial itself, it gives origin to an annual plant, which belongs to the natural order Melanthaceæ*. The root is spindle-shaped, tuberculous, fleshy, and about an inch in thickness at the summit, and gives out, laterally, a great number of greyish fibrils. In the dry state, and reduced to powder, the root of Veratrum operates as a pow-

* Woodville's Med. Bot. 3rd edit. p. 753, pl. 257.

erful Drastic Cathartic. According to the analysis of Pelletier and Caventou, it contains—1. a fatty matter; 2. an acidulous gallate of Veratria; 3. a yellow colouring principle; 4. starch; 5. gum; and 6. lignine*.

If we compare the quantity of the salt of Veratria contained in the root of this plant with that in the bulb of colchicum, it is surprising that it has not been substituted for the colchicum on every occasion. The other components are fewer and less likely to be taken up with the salt of Veratria, whether wine or alcohol be used as the menstruum, than when the bulb of the colchicum is employed: it is also less likely to spoil, owing to its containing less water than the colchicum bulb. In the root of Veratrum the only active principle is the gallate of Veratria; and the only question is, how can this be most advantageously separated, so as always to procure a preparation of a known and specific strength? One difficulty stands in the way; the gallate of Veratria cannot be procured in a crystalline form, and consequently must vary in strength according to the quantity of water combined with it. As one of the salts of Veratria, however—the sulphate, for instance—is crystallizable, it might be tried as a purgative; and, if its powers be equal to those of the gallate, we should thus be enabled to procure a preparation of a specific strength. In mentioning the poisonous properties of Veratria, when treating of colchicum, I stated that no antidote had yet been discovered; but on reflecting on the insoluble nature of pure Veratria, and the possibility of decomposing it, I am of opinion that an antidote may be readily found. Two salts at first present themselves to our attention as capable of effecting such a change—the acetate of lead and sulphate of iron; but in both cases a double exchange takes place, and the acetate and sulphate of Veratria are produced, both of which are poisonous. We know that magnesia precipitates pure Veratria from the gallic acid with which it is combined; but too high a heat is required to effect this, to render it useful as an antidote; and it is a daily custom to prescribe magnesia in conjunction with the various preparations of

* Annales de Chim. t. xiv, p. 81.

Veratria without rendering them inert. M. E. St. Maire, of Lyons, has proposed tincture of iodine as an antidote. Dogs, to which two grains of Veratria were administered, were saved on giving the tincture of iodine immediately afterwards. Too little attention has been given to this subject, which is one of great practical importance. The root of Veratrum *album* is seldom employed as a purgative.

2. COLCHICUM. *Colchici bulbus*. L. E. D.—This bulb, and the plant which bears it, has been already fully described (vol. i, p. 595). As a Cathartic, it operates powerfully, but chiefly upon the duodenum.

f. ELATIN.

This is the active principle of Elaterium, and constitutes one-twelfth of its weight. It is separated by digesting the Elaterium in strong alcohol, in a moderate heat, for twenty-four hours, filtering and washing the residuum with successive portions of fresh alcohol. By evaporating this alcoholic tincture to dryness, a solid green substance is obtained, which is next to be boiled in distilled water; what remains undissolved is Elatin. It is a nearly insipid substance, of a green colour, insoluble in water, soluble in alcohol and the alkalies; inflammable, burning with smoke and an aromatic odour. It is precipitated by water from its alcoholic and alkaline solutions, unaltered.* I have found that Elatin may also be readily procured by digesting Elaterium in ether: a clear green solution is produced; and this, evaporated on pure distilled water, leaves an insoluble pellicle, which is Elatin, purer than that obtained by the other process.

Elatin procured by Dr. Paris' process is not a simple principle. When it is acted on by ether, a substance is left which is soluble in alcohol; and which, on leaving the tincture at rest to spontaneous evaporation, crystallizes in acicular tufts. These crystals are nearly colourless; they are scarcely soluble in water and in diluted acids; they are fusible in a heat between 300° and 400° of Faht.; burn in the flame of a spirit lamp, and leave much charcoal. They do not form neutral salts with the acids. They consist of 17 parts of carbon, 18

* Paris, Pharmacologia, 5th edition, vol. ii, p. 205.

of oxygen, and 11 of hydrogen. Mr. Hennell, who discovered this principle, has named it Elateria*.

The activity of Elatin as a Cathartic is almost incredible; it operates violently when only one minim of an alcoholic tincture, consisting of one grain of Elaterium, dissolved in ninety-six minims of strong alcohol, is administered; thence it operates in doses of less than the ninety-sixth part of a grain. Elatin has not, however, been employed in its pure state, even in the alcoholic solution, as a Cathartic.

ELATERIUM, *Elaterii Extractum*, L. D.—is the dried juice of the wild cucumber, the fruit of the Momordica *Elaterium*, a plant which is a native of the South of Europe, but which is successfully cultivated in England for medicinal use, although it is annually destroyed by the severity of our winters. The plant belongs to the natural order Cucurbitaceæ†. Professor Richard has constituted it a peculiar genus, characterized by the separation of its fruit, and the scattering of the seeds from the orifice which is formed at the base of the fruit, when it leaves the peduncle, at the instant of its detachment: he has named it Ecballium.

The fruit of the Momordica *Elaterium* resembles a small oval cucumber, about an inch in thickness, an inch and a half in length, and is covered with thick, rough hairs. When it is fully ripe, the fruit suddenly leaves the footstalk with great force, scattering the seeds behind it like the sparks from a rocket, as it flies forward‡. The seeds, when fully ripe, are black, and are lodged in a light, green pulp, the cells or interstices of which contain from half a drachm to a drachm of limpid fluid; and it is from this only that the Elaterium is precipitated.

The fruit is gathered before it is ripe, and being cut longi-

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* Journal of Royal Institution, N. S. 1. p. 532.

† Woodville's Med. Bot. 3rd edit. pl. 72, p. 192. London Dispensatory, art. Momordica.

‡ The cause of the fruit spontaneously leaving the footstalk in the forcible manner which has been mentioned, and the scattering of the seeds often to the distance of several yards, has not been discovered. When the fruit is nearly ripe, a gentle touch of the hand will cause its instantaneous separation; and from this circumstance the common appellation of the plant, *Squirting Cucumber*, originated: and also its specific name, Elaterium.

tudinally, the juice of the pulp, surrounding the seeds, runs out; and this throws down the fecula, which, after the evaporation of the aqueous portion, forms the Elaterium of the Pharmacopœias. When it first flows out, it is perfectly limpid and colourless; but it soon becomes turbid; and, after some hours, deposites a sediment, from which the clear liquor is to be poured off, and the residue left to dry upon fine linen stretched upon a frame. It is most active when it is dried without exposure to the light. When genuine, it is in thin flakes or light cakes, of a very light-green colour, with a bitter, slightly acrid taste, which remains long upon the palate. It is nearly inodorous, although the plant, even in its dried state, has a peculiar aromatic odour. The Elaterium is often adulterated with starch, which is not easily detected, as there is a large proportion of fecula in Elaterium; but when thus adulterated, it has almost a white colour instead of a pale green; and when this is the case, there is reason for suspecting its purity.

Much of the value of Elaterium depends on the manner in which it is prepared. The juice of the fruit should be allowed to run out; for when the fruit is pressed, more of the inactive parts of the natural juice of the fruit is mixed with the Elaterium, which is consequently weaker in its effects. The insolubility of Elatin in water suggests a query—what keeps it in solution in the juice of the fruit? Were I to suggest an opinion, it would be that Elatin does not exist completely formed in the fruit; the fecula which subsides when the juice runs out of the fruit is in part the consequence of an oxidizement of it; for it becomes turbid soon after it is exposed to the air; and it loses much of its activity, or rather it does not become so active, when it is dried in a bright sunshine as when it is dried in the shade. Now, we know that light abstracts oxygen from substances containing it; as, for instance, from metallic oxides, which are partially reduced by exposure to light; and we may thence infer that substances which would attract and combine with oxygen in the shade may be prevented from doing so in a bright light; and, therefore, in this case, owing to the superior attraction of light for oxygen, the fecula may be prevented from acquiring

its due share of oxygen ; and, consequently, from acquiring the peculiar state of its constituents requisite for exerting its energy on the system. The lighter, more spongy, and the paler the green of the thin cakes, the more genuine is the drug ; but when it is of a dark green or grey colour, or approaching to black, when it is compact, heavy, and breaking with a shining, resinous fracture, it is not to be depended upon.

The experiments of Dr. Paris, in which he was assisted by Dr. Farraday, authorized him to state that the chemical components of Elaterium are, in ten grains,

Water	0.4
Extractive	2.6
Fecula	2.8
Gluten	0.5
Woody matter	2.5
Elatin	1.2
	10.0

The Elaterium found in the shops is generally imported from Malta. It seldom acts well under doses of a grain ; and the black kind, which is prepared from the expressed juice of the whole fruit, requires from two to four grains to act.

Although the term Elaterium is frequently found in the writings of the ancients, yet it is very difficult to determine what was exactly implied by it. Hippocrates applied the term to any violent purgative ; but it is evident that he also knew and prescribed the plant which we have before us ; for he mentions the Σικυς αγριος, under which name Dioscorides describes the Momordica *Elaterium* of our Pharmacopœias, and the method of preparing the juice of the fruit. The ancients used every part of the plant, both as an external application and as an internal medicine, in dropsical affections ; but the experiments of Dr. Clutterbuck ascertained that " no adequate substitute for the Elaterium could be found in the plant, exclusive of the fruit."

Like many other medicines, Elaterium seems to have suffered in the estimation of the old physicians from the indiscretion with which it was prescribed. Simon Pauli speaks

strongly of its violent effects ; and, in addition to his opinion, Lister and Hoffman accused it of causing great heat and pulsation even to the ends of the fingers. Notwithstanding the opinions of the ancients, Elaterium has again been brought into general use ; and when properly managed, it is the best drastic Cathartic, not only for completely unloading the intestines, but for promoting greatly the excretion of water from the bowels; and consequently emptying those cavities of the body in which serous fluid is apt to collect. Sydenham employed it in dropsy with success; Dr. Ferriar, of Manchester, restored it to practice. He employed it very successfully in hydrothorax, in combination with colchicum, squill, and spirit of nitrous ether. In my own practice, I have given Elaterium, in doses of one-sixth of a grain, repeated every four hours, and have seen it evacuate two gallons of fluid, by stool, in the course of twenty-four hours. In such cases, it is necessary to support the strength of the patient during its operation with ammonia and camphor. The administration of this Cathartic, however, under every circumstance, requires great caution, and the closest attention of the physician in watching its effects.

Elaterium has occasionally been exhibited in the form of suppository; that is, it has been introduced within the rectum, and left there. In this case, the dose may be one or two grains combined with hard soap.

The Dublin College have placed the leaves of Momordica Elaterium in the list of the Materia Medica. From what has been said, it is evident that no confidence can be reposed upon the use of any part of the plant.

* * INORGANIC SUBSTANCES OPERATING AS DRASTIC CATHARTICS.

1. Precipitated Sulphuret of Antimony. *Antimonii Sulphuretum Precipitatum.* L. E.—This precipitate is produced by boiling together two parts of Sulphuret of Antimony with four parts of liquor potassæ and three of distilled water. This solution is strained through a double linen cloth whilst it is hot, and diluted sulphuric acid dropped into it as long as any precipitate is thrown down. This precipitate,

after being washed with hot water and dried, is of a bright orange colour.

In this process, the Sulphuret of Antimony, which is composed of one proportional of metallic Antimony and one of sulphur, decomposes a portion of the water of the solution of potassa with which it is boiled, the hydrogen of which unites with the sulphur and the oxygen with the antimony of the Sulphuret, producing in the solution sulphur combined with hydrogen or sulphuretted hydrogen, oxide of Antimony, and potassa.

When the diluted acid is dropped into this solution, the potassa combines with it, forming sulphate of potassa, and the sulphur and sulphuretted hydrogen being thus set free, the latter is in part evolved, whilst a compound of the sulphur, the sulphuretted hydrogen, and the protoxide of antimony, is thrown down. According to the analysis of Thenard and that of Mr. Phillips, this precipitate consists of

Thenard.		Phillips.	
Sulphur	12.00	Protoxide	12.0
Sulphuretted Hydrogen	17.87	Sulphuret	76.5
Protoxide of Antimony	68.30	Water	11.5
Loss	1.83		100.0
	100.00		

Some chemists do not accord with the theory of the process which I have just described; but imagine that the precipitate is a simple Sulphuret of Antimony combined with water, the sulphuretted hydrogen and oxide of antimony reacting on one another when the potassa is withdrawn, the hydrogen of the one combining with the oxygen of the other to form the water, whilst the sulphur attaches itself to the freed Antimony forming a sulphuret. There is some plausibility in this theory; as the precipitate closely resembles that which is thrown down by transmitting a stream of sulphuretted hydrogen through a solution of tartar emetic. Regarding it as a hydrated oxysulphuret, its composition, independent of the water, will be 1 prop. of Protoxide of Antimony $= 76.6$, $+ 2$ prop. Sesqui-sulphuret of Antimony $(88.6 \times 2) = 176.12$— making the equivalent $= 252.18$.

This preparation is of a bright orange colour, inodorous,

with a slight styptic taste. It readily catches fire, and burns with a blue greenish flame, leaving the metal in the form of a grey oxide; which is a proof that it contains no oxide of iron, as in that case the residue is mixed with the red oxide of iron. To render this more certain, throw the residue into hydrochloric acid, and precipitate the solution by ferro cyanate of potassa: if no iron be present, the precipitate will be white; but blue, if iron be present. If the Precipitated Sulphuret be pure, it will not effervesce with weak acids; but effervescence will occur if it be adulterated with chalk. The pure precipitated sulphuret is completely soluble in liquor potassæ.

This preparation is not employed alone as a purgative; but it is a component of the Pilula Hydrargyri Submuriatis composita of the London Pharmacopœia, which, in doses of from gr. viii to gr. xvi, operates very briskly on the bowels, when it does not produce vomiting, which it sometimes excites, particularly if it meet with acid in the stomach. It is, however, a very uncertain preparation.

D. CLYSTERS.—ENEMATA.

These consist of cathartic substances largely diluted and injected into the rectum. Before entering upon the consideration of the practical application of purgatives, it is proper to examine briefly the manner in which these operate.

The intimate relation between every part of the alimentary canal, and between it and the system in general, enables medicines to operate nearly in a similar manner, whether they be taken into the stomach, or injected into the intestinal canal, or applied to any part of the surface. In many instances the stomach is in such an irritable state that it rejects all kinds of medicines; in other instances, large quantities of medicines are occasionally taken by the mouth without producing any effect; in others, again, deglutition is impeded by lock-jaw, apoplexy, or some similar causes. In all these cases, injections or Clysters, *Enemata*, may be resorted to; and they greatly aid the operation of Cathartics, by exciting the lower portion of the canal and the larger intestines.

In habitual costiveness, arising from a torpid state of the

bowels, a pint of cold water, thrown daily by means of the gum elastic syringe into the rectum, not only excites the natural peristaltic movement, but adds tone and activity to the entire gut. A table-spoonful of common salt, or of castor oil, augments the cathartic effect of this Clyster; but if the constipation be obstinate, or attended with flatulent colic, and an active operation be required, what is termed the terebinthinate glyster is generally employed. This is made by triturating about an ounce of turpentine with yolk of egg or mucilage of gum and adding a pint of milk; or half that quantity of infusion of senna, if it be necessary to stimulate more briskly the lower bowels. All the purgatives and drastic Cathartics, combined with any bland fluid, may be employed as Clysters; decoction of colocynth, or infusion or decoction of senna, combined with any of the saline purgatives, are the usual kinds of Enemata in ordinary cases. Even hot water, in sufficient quantity to stimulate by distention, often answers every purpose which can be desired from the use of Clysters.

Besides turpentine, infusion of tobacco is frequently employed as a clyster. Tobacco, when applied to any mucous membrane, stimulates powerfully; but when thrown into the rectum, either in infusion in water or in the form of smoke, it operates chiefly on the nervous system, relaxing spasm, and diminishing, almost instantaneously, all the powers of life; and not unfrequently its sedative effect has been followed by death. The strong aqueous infusion paralyses the heart and quickly destroys life: the essential oil contained in the smoke excite convulsions and coma without affecting the heart; but it proves equally fatal. Both act on the nervous system. Dr. Macartney, of Dublin, has confirmed the observation of M. Orfila, that, like other violent poisons, it has no effect when applied directly to the denuded brain or nerves. But this affords no argument against the opinion that it operates through the medium of the nerves; since there is a very great difference in the effect of an impression made upon a nerve in any part of its course, or at its origin in the brain, and its sentient extremities.

The quantity of the tobacco ordered by the Pharmacopœia

for making the infusion is one drachm to one pint of water; but the effects of this infusion depend very much upon the quality of the tobacco and the manner in which it has been prepared; and something, also, upon the habit of the patient. I have seen cold sweats, the most alarming diminution of pulse, and syncope, caused by one half the quantity which I have mentioned. Indeed, such is the risk attending the employment of the tobacco Clyster, that nothing but a certainty that spasm is the cause of the obstruction of the bowels, and that it has resisted every other means of relief, can authorize the use of this Enema.

Besides the infusion, the smoke of tobacco is thrown into the rectum, with the view of overcoming the obstructions similar to those which require the employment of the infusion; and certainly much less risk is likely to result from the employment of tobacco in this form than in that of infusion: its efficacy, however, it must be acknowledged, is also less. A particular apparatus has been invented for exhibiting tobacco fumes as a Clyster; but every practitioner should, if possible, be independent of these *useful* inventions, which are not always at hand, and the absence of which ought not to prevent the employment of a remedy when it ought to be administered. When the machine alluded to, which is a double bellows with a box interposed between its body and the nosle, for putting the lighted tobacco in, so that the stream of air passing through it carries the smoke of the ignited herb into the rectum—when this machine is not at hand, its place may be supplied by a common clay tobacco pipe, the small end of which being oiled and introduced into the rectum, and a piece of cloth applied over the mouth of the bulb, in which the ignited tobacco is held, the smoke may be blown by the breath of the nurse or any attendant into the bowels of the patient. It might be supposed that as the breath issuing from the lungs is unfit to support combustion, being chiefly carbonic acid gas, it would extinguish the tobacco; but this is not the case, the quantity of nitre in the tobacco being sufficient to maintain its combustion, independent of the atmospheric air or any gaseous supply of oxygen.

Much of the inefficacy of Clysters, in many instances,

arises from their not reaching the obstructed part of the canal, even when forcibly urged by the usual apparatus for exhibiting them; indeed, they seldom pass far beyond the sigmoid flexure of the colon; they operate, therefore, by exciting only the lower portion of the bowels, and produce merely partial discharges; for although there is a general sympathy of action in the whole intestinal canal, in its healthy state, yet this has not much influence in those diseases which are accompanied with obstinate obstructions of the bowels. Clyster ought always, on this account, to be administered by means of the stomach pump; so that, by apportioning the force of the pump, the fluid be conveyed to any part of the intestinal canal.

It is of importance that the young practioner should know the proper bulk of Enemas for different ages. The usual quantity for an adult is a pint of fluid, that for an infant not more than three fluid ounces; so that, between these points and taking into consideration the size of the individual, the quantity proper at different ages may be readily determined. If too much fluid be employed, the Clyster acts by its bulk, as well as by the stimulus of the material administered; the reaction of the gut upon its foreign contents is too quick; and, by the sudden return of the Clyster, the object of the prescriber is defeated. But it is equally necessary that the quantity should not be too small; as, in that case, it remains too long in the bowels, and often fails altogether to excite their action.

Besides Cathartics and Enemas, the peristaltic motion of the bowels may be increased by various external means. Thus, in simple torpor of the gut, the electrical aura is highly useful; and in obstinate costiveness, particularly in the case of ileus, when all other means have failed, dashing cold water on the lower extremities has succeeded in procuring the immediate evacuation of the intestines.

THERAPEUTICAL EMPLOYMENT OF CATHARTICS.

Having completed our examination of the various substances which are usually employed as Cathartics, it now

only remains to advert to their practical employment as remedial agents in the treatment of diseases.

Before considering this subject, however, it may be useful to point out the symptoms, independent of the existence of specific disease, which indicate the administration of Cathartics. These, exclusive of a confined state of the bowels, are a whitish, yellowish, or blackish appearance of the tongue, or dryness of that organ, with thirst and any unusual taste in the mouth; fulness of the lower belly, either with or without tenderness on pressure; the urine saffron-coloured or loaded with bile; and fluid dejections with borborygmi.

The *first* general intention of administering purgatives is to clear the intestinal canal; for which purpose, they must be given in full doses, and those purgatives selected that will act on the whole course of the canal; such, for example, as castor oil, or a combination of tartrate of potassa and infusion of senna.

The *second* general intention is to correct unhealthy secretions; and this is to be effected by calomel given at bed-time, followed by a purgative in the morning. The symptoms indicating this practice are, the tongue covered with a whitish slimy coating, the white of the eye suffused with yellow, and the skin dry, harsh, dingy, and sallow.

The *third* general intention is to keep up a discharge from the intestinal exhalants, so as to lessen the bulk of the circulating mass and to lower excitement, which is best accomplished by small repeated doses of neutral salts; as, for instance, from ℥ss to ℥i of sulphate of magnesia, repeated at the distance of five or six hours, for several successive days. And it is important to recollect that, in many instances, purgatives have as debilitating an effect as blood-letting.

The *fourth* and last intention is to lessen the determination of blood to particular parts; thereby employing a purgative to produce the effect of a counter-irritant.

In reference to disease, Cathartics are advantageously prescribed in every form of fever; and in the commencement they often arrest its progress. The intentions which have led to their employment in this class of diseases are founded, more or less, upon the theory which at the time has swayed

the opinions of medical men. Thus, when fevers were supposed to depend on a morbific matter, which it was essential to expel from the habit, they were given to effect this in every stage and every form of fever, not even excepting intermittents: and thus I might proceed, detailing theory after theory, were it necessary to descant upon modes of practice dictated by opinions which have been long since forgotten. But if such an enquiry would be a sacrifice of time, it is nevertheless proper to examine the circumstances by which their administration is to be regulated in each description of fever.

In intermittents, the subsequent treatment by tonics is greatly aided by the employment of brisk Cathartics, in the first instance, to clear out the intestinal canal: their subsequent employment, however, must depend very much upon circumstances. Thus, in warm climates, there is generally a greater derangement of the biliary organs than in cold climates; and therefore Cathartics are more required, and have been found generally useful. They are not so necessary in cold climates; but in these, season makes a difference, and experience has demonstrated that autumnal agues require more purging than those of spring, owing to the derangement of the biliary organs which then occur. With respect to the period of the disease—they certainly ought not to be given so that their operation shall occur in the cold stage of the disease, which they always protract by weakening the powers of reaction; and they are equally inadmissible in the sweating stage, as they tend to cut this short and to change the intermittent to the remittent type. In the hot stage, they are indicated when there is much oppression at the præcordia, and symptoms of determination to the head are present: but the time to administer them with least hazard is during the apyrexia or intermission. The symptoms indicating the use of Cathartics in intermittents, are the presence of much arterial excitement, great derangement of the abdominal viscera, headache, and dyspeptic feelings. The division of the Cathartics best suited for intermittents, is that of Purgatives—for example, Calomel and Rhubarb; but if they are required merely to regulate the bowels, nothing answers better than Aloetics. In prescribing Cathartics, however, in intermit-

tents, it should be recollected that, as agues are diseases of depression of strength, much purging is always injurious; for, after the disease has continued for some time, and is yielding to tonics, the exhibition of a brisk Cathartic will often renew the paroxysm with all its original violence, and render the subsequent treatment more difficult, and the disease more protracted than it would have otherwise proved. This is an observation which was made by Sydenham and De Haen; and has been confirmed by the experience of every subsequent attentive observer.

The opinions regarding the efficacy of Cathartics in continued fever have been very opposite. It had been observed that diarrhœa, spontaneously occurring, sometimes proved critical in continued fever; and, therefore, Cathartics were supposed to be capable of cutting short the attack; and, undoubtedly, when there are vitiated biliary and intestinal secretions, they have proved useful in preventing the formation of both remittent and continued fevers: but it is very doubtful whether a fever, fairly formed, was ever cut short by Cathartics. The bile may be vitiated by any morbid state of habit affecting its secretion. We know nothing that will correct this state of bile; thence the importance of carrying it quickly out of the habit; and this can only be effected by purgatives which stimulate the duodenum, by which not only the bowels, but the liver is emptied. They have been used to cure continued fevers, even typhus, after they are established; and the custom of prescribing them in modern times may be ascribed, in a great degree, to the work of Dr. Hamilton on Purgatives. That experienced physician regards their utility to depend on "their acting through the whole extent of the intestines, and their carrying off feculant matter, rendered offensive and irritating by constipation." He recommends a purgative of an active nature to be given daily; and to be repeated more than once in that period, if full purging be not effected by it. But, notwithstanding the success of Dr. Hamilton, and his high authority, it cannot be denied that a course of purgatives, even the most judicious, will often fail to cure continued fevers. After the formation of these fevers, all that the physician can do is to watch their

progress, to alleviate the symptoms, and to obviate, as the late Dr. James Gregory used to express himself, "the tendency to death." Cathartics are, therefore, useful as auxiliaries; but they cannot be regarded as the remedy for the cure of fevers.

When Cathartics are indicated in continued fever, they cannot be administered with propriety in every form and stage of the disease. When the fever is accompanied with great arterial excitement, Cathartics are well adapted to diminish this state; particularly the saline purgatives, administered in moderate and frequently repeated doses. In synochus, they may be given with freedom in the early period of the disease; yet much caution is requisite in their after administration. In pure typhus, when there is much morbid irritability of the stomach and the intestinal canal, the use of Cathartics require great caution; nevertheless, symptoms frequently occur in the progress of the disease which demand their employment; and we are not to be deterred from prescribing them by the name of the fever. Whenever the secretion of the liver is so much augmented as to produce that yellowness of the skin and of the white of the eye which accompanies typhus, particularly in tropical climates, and in summer and autumn in our northern latitude, Cathartics are indicated, and must be administered.

It was the practice of the physicians of former times to delay the administration of Cathartics until the decline of continued fevers; in order, as they imagined, that the morbific matter should be concocted and rendered proper to be expelled. The experience of modern times has demonstrated both the fallacious reasoning and the inpropriety of the practice of our ancestors in this respect. The employment of Cathartics, as I have already stated, is contraindicated, at the conclusion of these fevers, by the debility which always accompanies their decline; but much of this debility may be obviated by the judicious administration of purgatives, when they are indicated in the early stage of continued fever. Their early administration prevents also the occurrence of diarrhœa in the decline of the disease; this state being often the consequence of accumulation of feculent matters, altered from the

healthy state and rendered more irritating by the previous derangement of the system. On this account, also, the administration of Cathartics is useful in convalescence from fever, to prevent relapses from the accumulation of crude and undigested matter, in that period when the appetite exceeds in keenness the digestive powers of the stomach. Upon the whole, we may justly conclude, that Cathartics may be advantageously employed in every stage of continued fever, when the symptoms require them. These symptoms are a phlogistic diathesis, or highly excited state of the system, known by a hard, full pulse, thirst, a dry, hot skin, and high-coloured urine. There are states, however, in which these symptoms are present, in which Cathartics are of little avail without the aid of the lancet or of blood-letting, either by means of leeches or of cupping—thus, when there is a determination of blood to some particular organ, as the head, the chest, or the stomach. When the functions of the intestinal canal are deranged, marked by obstinate constipation, when the fæces are dark-coloured and fœtid, Cathartics are particularly indicated and, until this state is changed, require to be repeated daily. If, however, even with these symptoms, the debility is great, the Cathartics must not be given in full doses: but, as debility arises from very opposite causes, it consequently requires to be removed by very opposite means. If it be kept up by irritating matters in the intestines, augmenting the degree of fever, it is obvious that, by removing these, Cathartics will have the effect of diminishing instead of increasing debility; but when it is the result of long-continued febrile action, independent of such local irritation, then purging becomes injurious. It is, nevertheless, requisite to regulate the bowels; and, with this in view, clysters may be employed instead of Cathartics, and are often of great advantage in effecting daily, regular discharges from the intestines.

With regard to the selection of Cathartics in continued fever, much will depend on the nature of the attack, its period, and the constitution of the patient. If the bowels be easily moved, no purgative is so agreeable, so well adapted for fevers of a typhoid character, as the bitartrate of potassa;

but often the bowels are so torpid, that the more powerful are requisite, even when the debility is considerable. Those which require much time to produce their cathartic effects are not to be employed; as the quicker the operation is produced, the better: calomel, in combination with an antimonial and rhubarb, or followed by a saline purgative, is the best Cathartic in such cases. On every view of the subject, we should ever keep in view these remarks of Dr. Hamilton —"that, while purgative medicines preserve a regular state of the body, they do not aggravate the debilitating effects of fever. The complete and regular evacuation of the bowels, in the course of fever, is the object to be attained. Within this limit," says this venerable and experienced physician, "I have had much satisfaction in prosecuting the practice; nor have I, in a single instance, had occasion to regret any injury proceeding from it; for I am not an advocate for exciting unusual secretion into the cavity of the intestines, and for procuring copious watery stools: these, while they are not necessary, might increase the debility so much dreaded*." But, on taking this advice as our guide, we must be certain of the condition of our patient; for it occasionally occurs that accumulations take place, when both the patient and the nurse report that the bowels are freely opened: not to purge in this case would be injurious; but, in satisfying ourselves of its necessity, the purgative must be such as will act fully, and will fairly clear the intestinal canal. On the contrary, when unhealthy secretions, pain, tenderness, and flatulence, do not soon yield to purgatives, their employment should be discontinued; as these symptoms, instead of being removed, are sometimes kept up by the use of the Cathartics. The physician who purges indiscriminately, in continued fever, should receive his fees from the undertaker; for the hope that the patient can profit by this practice is a vain delusion.

In fevers accompanied with topical inflammation and pains, however useful Cathartics may be in removing feculent irritating matters from the intestinal canal, it is only for such a purpose they can be employed; their effects, as evacuants,

* Hamilton on the Utility and Administration of Purgative Medicines in several Diseases.

acting on the general circulating mass, are too slowly produced to be essentially useful in this description of fevers; and they never can supersede the employment of the lancet. In some cases, even their stimulant operation, if abdominal inflammation exist, may produce much harm, and greatly counterbalance any benefit derived from their cathartic influence. Rheumatism and gout, however, are exceptions to this rule. In the commencement of the former, purging is not only useful, but essentially necessary, particularly in the acute form of the disease. Nature has pointed out the advantage of this plan of treatment, by the beneficial effects which follow the occurrence of diarrhœa in rheumatic attacks. During the free action of the bowels, the pains are suspended; and if the diarrhœa be not suddenly checked, it generally carries off the rheumatism.

The alliance between gout and rheumatism is so very close, that the treatment beneficial in one is applicable to the other. This was a very ancient practice; the Hermodactylus of the ancients, our Colchicum, was the remedy employed to effect this intention; and, that its chief benefit arises from its purgative properties, rather than from its sedative quality, I am satisfied is the case, from the most ample opportunities which I have enjoyed of tracing its effects in this disease. It operates chiefly on the duodenum, powerfully stimulating the gall ducts, and emptying the liver of its contents. Indeed, in scarcely any instance have I observed gout relieved by Colchicum until the evacuations, which are chiefly bile, fresh supplied from the gall ducts, flow freely.

The student who is informed that gout was formerly cured solely by purgatives, will naturally enquire, why was the practice set aside? The only reply is, that the authority of Sydenham enslaved the minds of his followers; and, for nearly a century, physicians, misled by a name, abandoned the disease to itself, to exhaust its violence by time. This great physician conceived the idea that it was an inviolable law of Nature that diseases should be thrown off by the extremities; thence, in gout, he forbade the use of Cathartics—" nisi ut materia peccans," says he, " quam Natura in corporis extremitates protruserat, in sanguinis massam denuo revoce-

tur:" an opinion purely hypothetical, and which is now happily exploded. Gout, in every instance, is a disease of depraved digestion; to relieve it, not only purging, but the most complete evacuations of the whole alimentary organs is essential. Colchicum, in effecting this, produces the well-known benefit derived from its employment, and not by any specific or occult quality.

In thoracic inflammation Cathartics are not of great use; although, after free blood-letting, it is of the utmost importance to maintain the regular action of the bowels. In Enteritis, notwithstanding the dread of our Continental brethren, purging, after blood-letting, is not only admissible, but necessary; and, instead of increasing the inflammatory action which constitutes the disease, it is often the most effectual means of maintaining and extending the benefit derived from the use of the lancet: besides removing hardened fæces or other causes of inflammation, purging, by increasing the secretion of fluids into the intestines, unloads the vessels and relieves the diseased parts by the same process which Nature adopts. In strangulated hernia, after reduction of the gut, much of the danger of the case is lessened by freely unloading the bowels. In diseases of the other abdominal viscera, their administration requires much consideration: thus, when the liver is oppressed with an excess of its natural secretion, purgatives are productive of the most salutary effects; but when it is suffering under inflammation, they augment the excitement and are productive of mischief. In indurations of its tissue, also, purgatives, in small and frequently repeated doses, prove beneficial and permanently useful; while, in hypertrophy of the organ, even when they produce the evacuation of much bile, trivial and momentary relief only, follows their employment.

The close sympathy between the skin and the intestinal canal readily suggests the advantages to be derived from purging in contagious febrile affections, accompanied with eruptions on the skin, which run a particular course. In small pox, next to cool air, nothing so much moderates the violence of the symptoms as the judicious administration of purgatives: they allay heat, reduce the general excitement, and, consequently,

lessen the crop of pustules: and the same advantages arise from the use of the milder laxatives in measles. Much prejudice has existed against the employment of Cathartics in scarlatina. It is remarkable to find that this dread was even felt by so judicious a physician as Dr. Willan; and, although it is gradually subsiding, yet, that it still continues to haunt the imaginations and modify the practice of many otherwise excellent practitioners. As far as my experience in the treatment of this disease extends, I feel authorized to say that Cathartics benefit not only by diminishing the fever and favouring the cure of the disease, but also by preventing those dropsical swellings and visceral derangements which follow it, and, when they have been permitted to take place, Cathartics are the best means of removing them.

Cathartics are useful in erysipelas, when it assumes what has been termed the phlegmonous character; but when it is accompanied with symptoms of low fever, delirium or coma, when the colour of the affected part is dark-red, and the vesications assume a livid hue, they must be given with the greatest circumspection: on the contrary, along with the employment of bark, the mineral acids, opium, and wine, the mildest aperients only are admissible in this state of the disease. If it be necessary, however, to open the bowels more freely, even in this form of the disease, terebinthinate enemata may be exhibited with decided advantage.

In the hæmorrhagic affections, the employment of Cathartics will depend on the nature and kind of the hæmorrhage. In passive hæmorrhages, when the flow of blood is the consequence of a weakened condition of the coats of the vessels, connected with a general state of debility, purgatives, except merely to obviate constipation, are undoubtedly contraindidicated: but, in active hæmorrhagy, they are advantageously given during the intervals of the bleeding, both to reduce the general phlogistic diathesis and to promote the balance of the circulation. In hæmatemesis, Hoffmann, Frank, and many other excellent Continental physicians, reprobate the use of purgatives; but, in many cases of this disease, British practitioners place much confidence on them, particularly when this form of hæmorrhage is connected with uterine torpor

and sluggish bowels; and the benefit has been found to extend even to chlorotic and leucophlegmatic habits. It must, however, at the same time be admitted, that their inconsiderate employment in exhausted constitutions, and especially when this arises from the progress of organic disease, may prove highly pernicious. In hæmoptysis, purgatives of the saline kind are useful, by the determination which they effect to the mucous membrane of the intestinal canal, and the reduction of the mass of the circulating fluid which follows their action.

In hæmorrhoids, whether depending on a dilated state of the veins, or, as it is termed, a varicose state of the hæmorrhoidal veins, or on fungous and polypous growths of that part of the intestinal tube, the accumulation of fæces, by pressing upon these irritable tumors, augments the disease and induces severe pain; thence, the aid of purgatives is required. In this disease, however, the kind of purgative to be employed is of importance; in the majority of cases, those which operate mildly and promote the regular excretion of the fæces are the best adapted for this disease. Castor oil, sulphur, and the saline purgatives, are generally those which the nature of the disease requires; but although many of the resinous Cathartics are too violent in their operation—and we are particularly warned, in most works on the treatment of diseases, against the use of aloës—yet even aloës may be employed, if given in doses sufficient merely to keep up a regular discharge. The local effect of resinous purgatives on the rectum even proves useful in this affection; as may be observed in the effect of copaibæ: and experience has demonstrated, also, the beneficial influence of another stimulant, Ward's paste, the chief ingredient of which is long pepper, a substance which stimulates the whole of the canal from the duodenum to the rectum.

Cathartics are generally administered in dysentery. When the intestinal inflammation is not preceded by diarrhœa, the contents of the bowels acquire an acrid character, and require to be removed; but, in effecting this, we must bear in recollection the inflammatory state of the colon and rectum, and employ castor oil, or even milder purgatives, as soon as a little

respite from pain has been obtained by bleeding. Drastic Cathartics, instead of relieving the disease, tend to augment the tendency to tenesmus, the most distressing of its symptoms.

In apoplexy, Cathartics, and those of the most active description, are often requisite. I have hinted the great advantage of employing the oil of Croton *tiglium* in this disease, when deglutition is completely impeded. The merely placing a drop of this oil upon the tongue is sufficient to excite the evacuation of the intestines. In stating, however, the importance of this class of medicines in apoplexy, it is obvious that little can be expected from the administration of purgatives, except in aid of the lancet. When they prove beneficial, the result must be ascribed as much to their counter-irritant as to their evacuant influence.

In many other affections of the head, Cathartics are the remedies to be chiefly relied upon. In the commencement of hydrocephalus, for example, the disordered state of the stomach and the comatose tendency are often readily removed by active purging. Indeed, in families in which there is a strong predisposition to the disease, I have succeeded in warding it off, until after the age in which its attacks are most frequent and most to be dreaded has passed, by a constant attention to the state of the bowels.

In maniacal affections the ancients rested their chief reliance on Cathartics, and black hellebore was the medicine they employed for fully evacuating the intestinal canal in these cases. But although this faith in the virtues of hellebore kept its ground for upwards of two thousand years, yet it fell into disuse; and hellebore is now altogether neglected in this class of diseases: the general utility of purging, nevertheless, in maniacal cases is undoubted. In the commencement of the disease and during what may be regarded its active stage, purging is not only useful, but absolutely necessary; the secretions at those periods of the disease are always of a vitiated kind; and when the torpidity of the bowels is great, particularly in incipient attacks, large quantities of vitiated bile and feculent matters collect in the cells of the colon; thence, the irritation excited by these greatly increase

the cerebral excitement; and as ordinary purgatives will not remove these, the more drastic are indicated. For this purpose it is sometimes necessary to employ elaterium and oleum tiglii, in conjunction with calomel. In general, however, such active measures are not required in the treatment of insanity; and after the bowels have been well cleared, it is sufficient to keep them regular by the use of simple laxatives, if diet and exercise be insufficient for this purpose.

The torpid state of the bowels in maniacal cases often admits accumulations to take place to a very extraordinary degree, without the suspicion of the practitioner being directed to this cirsumstance. The bowels are daily opened, but fluid stools only are passed; and even when purgatives are administered, and ample evacuations apparently obtained, yet no sufficient relief results, there is still a sensation of uneasiness; and, as the patient expresses himself when he is capable of stating his feelings, a load remains. In such circumstances, if an examination be made per anum, the rectum is found to be dilated, and an accumulation of fæces is discovered immediately within the sphincter muscle. In one case, which came under my care, in which such an accumulation occurred, it was necessary to dilate the anus and to take away the hardened fæces by means of a spoon. The quantity was sufficient to have filled a bladder of considerable size; and, from the induration of some parts of it, must have been accumulating for a considerable time. After taking the whole away, the intestine was strengthened by injections of cold water; and the evacuations being regulated, so as to prevent future collections of a similar kind, the patient rapidly recovered under the usual treatment; and has since, that is for upwards of seven years, remained in perfect health. In general, the excretions in mania are dark-coloured and extremely fœtid: it is this state which chiefly demands the use of purgatives; and they should be continued, if the constitution of the patient permit, as long as it continues.

When debility, in mania, has been induced by long-continued violence, or by want of due assimilation of the food,

clysters are more requisite for regulating the bowels than purgative medicines administered by the mouth. But the young practitioner should be aware that maniacs often resist the natural tendency of the bowels to relieve themselves; and, yet, that the difficulty of getting medicines introduced into the stomach is such as to render the evacuation of the intestines a matter of the greatest uncertainty. In such cases, elaterium or the oil of tiglium must be resorted to; and these may be given in such small bulk that we can almost always depend upon getting the bowels evacuated by their means. Upon the whole, although the ancient opinion of strong purging as a remedy in maniacal cases be founded on an untenable hypothesis, yet, as far as it can be accomplished, a daily evacuation of the intestines is essentially necessary in mania; and, as far as this is deficient, or when the secretions are in an unhealthy state, Cathartics are most important auxiliaries in this class of diseases.

In all spasmodic diseases, as every source of irritation in the intestinal canal tends to increase the irregular actions which characterize these affections, Cathartics, in removing such causes, prove highly beneficial. In noticing this effect of Cathartics, however, in spasmodic affections, it is requisite that we should be aware that, owing to peculiar idiosyncracies, some Cathartics induce the very diseases which they are often employed to remove. Instances have occurred in which a dose of rhubarb produced every symptom of epilepsy; and, in an instance within my own observation, the smallest dose of calomel produces the most alarming syncope.

Hysteria is undoubtedly a disease intimately associated with a morbid condition of the alimentary canal. The preceding symptoms are pains in different parts of the abdomen, sour eructations, hiccup, flatulence, constipation, vomiting sometimes, and purging, indeed the usual symptoms of dyspepsia; and after these have continued for some time, sudden alarm, or any circumstance which can powerfully affect the nervous system, will bring on all the convulsive efforts which characterize hysteria. Dr. Hamilton regards hysteria in this point of view; and considerable improvements in the management of the disease have resulted from the purgative

practice which he introduced; but, nevertheless, purgatives alone will not cure hysteria. Whether the disease, however, be of a description to require the use of the lancet or the administration of tonics, in either case recovery is much promoted by the free employment of purgatives. In the one case the phlogistic diathesis is removed more speedily by the aid of the Cathartics; in the other, the alimentary canal being relieved, the tone and vigour of the system is more easily restored than it otherwise would be were purgatives not employed.

It is highly probable that in both varieties of tetanus the exciting cause is a morbid irritation; which, if it cannot be traced to a wound, must be looked for elsewhere, and in no place is it so likely to be found as in the alimentary canal. This view of the exciting cause of what is termed idiopathic tetanus is confirmed by the frequent occurrence of this variety of the disease in countries where the food is of a crude and indigestible kind. In Sir George Mackenzie's Travels in Iceland, we are informed that, in the group of islands called Westmann-Eyar, situated on the southern coast of Iceland, almost every child born there is cut off by lock-jaw. These islands are formed of lava; the inhabitants are remarkably indolent; their food consists chiefly of salted fulmars and puffins—very fat, oily sea birds. They have no vegetable food. The disease, therefore, appears to arise from the effect of bad food on the constitution of the mother, and also from the practice of giving to the infant a strong and oily animal diet almost immediately after birth. Whatever may be the nature of the irritation which produces tetanus, it is excited by the effect of this on the nerves of the spinal marrow which supply the muscles of respiration. In idiophatic Tetanus, if the bowels be cleared out, much of the difficulty attending the cure of the disease is set aside*. But, if the utility of

* I cannot avoid taking this opportunity of making public my experience of the powerful influence of cupping along the spine, in relieving the spasmodic rigidity of the muscles in tetanus, in conjunction with the exhibition of cathartic glysters, as long as the jaw remains fixed; and purgatives, combined with opium, on the first moment that any relaxation of the spasm permits their introduction into the stomach. I have had an opportunity of witnessing the successful effects

purgatives were at all problematical in Tetanus, in adults, there is no difference of opinion respecting the employment of them in the lock-jaw of infants. In proof of their efficacy in this affection, numerous cases have been recorded by various authors: indeed, when we consider that in every instance the disease in infancy can be traced to some irritation of the abdominal viscera, we cannot for a moment withhold our concurrence in the propriety of the active employment of Cathartics for its relief. In such cases, the importance of those Cathartics, such as the oil of tiglium, which operate when merely applied upon the tongue, as they can be administered if the smallest instrument can be introduced between the teeth, becomes obvious.

No disease admits of so much benefit from the use of purgatives as Chorea, St. Vitus' dance. In the commencement of this disease, gentle purgatives, repeated at moderate intervals, are more useful than drastic cathartics; and when at the same time the irritability and mobility of the habit is lessened by the administration of nitrate of silver as a tonic, a cure is often speedily effected. When the disease, however, has long held possession of the habit, and custom has some share in maintaining its influence over the nervous system, the Cathartics must be of the most active description, and given in such succession that the effect of one dose shall be still felt at the time of administering the next. Unless such an impression be perpetuated on the intestinal canal, I have seldom seen much benefit derived from this method of treating Chorea. It was the custom of Sydenham and the older physicians to purge freely in Chorea; and, at the same time, to bleed both generally and topically. I have never seen any advantage obtained from this practice: on the contrary, after the due evacuation of the intestines, that is, as soon as the stools assume a healthy aspect, tonics of the most powerful kind can alone be depended upon for the establishment of the cure.

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of this plan of treatment in two cases; one of which was a case of traumatic tetanus. Blood was drawn from the cervical portion only of the spine; but dry cupping was employed throughout the whole length of the spine three times a day. The patient informed me that, each time the cups were applied, the acute pain under the apex of the sternum was always relieved, and did not return for some time afterwards.

Indeed, however important purgatives are in the treatment of Chorea, as long as the bowels exhibit appearances which demand their administration, their continuance beyond that point is rather productive of mischief.

An interesting case is detailed by Dr. Bostock, in the seventh volume of the Medical Gazette, of a boy having been cured of stammering by purgatives. Dr. Bostock thinks that stammering often depends on a state of certain muscles, resembling that condition of all the muscles in Chorea, and which may be termed local Chorea. The alvine discharges were offensive and dark-coloured.

In some forms of dropsical effusions, practitioners have long and justly relied upon the efficacy of Cathartics. Sydenham recommends their daily employment, provided the strength of the patient admit of such continued purging. No practice can be more sound than this in those cases of dropsy which are connected with an inflammatory state of the system; and Cathartics are still more beneficial in these cases when they are employed in conjunction with blood-letting. I have already stated, that, from the property of the drastic Cathartics to produce watery discharges from the bowels, they were termed *hydragogues* by the ancients, and were conceived to be peculiarly well adapted for the cure of dropsy. In many respects this opinion is correct; and when dropsy is attended with a torpid state of the alimentary canal, with great fulness and activity of the arterial system, drastic Cathartics are highly beneficial. But, in adopting this opinion, we must recollect that dropsy is also occasionally a disease of debility, the result of a weakened and exhausted state of the system, or of some local affection. In such cases Cathartics are not admissible; indeed, I might almost say that *anasarca* and *ascites* are the only forms of dropsy in which purgatives are absolutely indicated. In hydrothorax, or a collection of watery fluid in the chest, on the contrary, they are wholly inadmissible: they do not sufficiently stimulate the capillaries in these cases; but, by increasing the debility, they augment the difficulty of breathing, not only by allowing the fluid to accumulate and narrow the capacity of the chest, but by generally weakening the habit, and increasing the dif-

ficulty of expanding the thorax and enlarging the breathing portion of the lungs to an extent requisite for effectually carrying on the function of respiration. Even when drastic Cathartics are admissible in hydropic complaints, they should not be administered on successive days; and, if their proper curative effect be not obvious in a short time, their continuance is injurious, by increasing the debility of the general system. During the intervals of their administration, tonics and moderate stimulants are indicated to support the strength. When drastic purgatives prove beneficial, the effect is probably the result of the excitement of the exhalant arteries of the intestines, which, by pouring out their contents, abstract a great quantity of serum from the circulating mass; so that the blood is thereby deprived of much of its fluid matter.

In Jaundice, Cathartics have been employed with two objects in view: to remove local obstructions to the flow of the bile into the duodenum; and to stimulate the liver to increased action, as far as regards the secretion of bile, when this is deficient. Cathartics, by stimulating the orifice of the common duct, and at the same time augmenting the natural movements of the intestines, convey a new excitement to the duct, which enables it to force forwards any calculus or inspissated bile in it, and thus to aid its expulsion. With respect to the Cathartics proper for this purpose, calomel is almost invariably one of those selected. It has undoubtedly a powerful influence on the duodenum; and, in conjunction with aloetics, is perhaps the best Cathartic that can be employed in jaundice. The bile is often prevented from passing into the intestines by the state of the intestines themselves, independent of any obstruction from calculi. This is particularly the case in young patients, in which the obstructing cause is not unfrequently a viscid state of the secretion of the duodenum, arising from a deficient secretion of pancreatic fluid to stimulate the glands of the duodenum. In some cases, even foreign substances, passing undigested from the stomach, act as the obstructing causes. In all these instances, Cathartics are the best remedies; and, even when the disease is in the liver itself, and scirrhus exists, or the duct is obliterated by cohesive inflam-

mation, more than one instance of which has come under my notice, Cathartics are still indicated for relieving the obstinate constipation which always accompanies a deficiency of bile in the intestinal canal. In this state, the best Cathartic is aloës; not, however, because it is bitter, and may supply the defect of bile, but because its cathartic operation is always followed by a lax state of the bowels. It is a curious effect of the repetition of calomel in some habits, that it causes white stools and evidently tends to bring on jaundice. It has been supposed that, in these cases, gall-stones previously exist in the gall-bladder, and that the stimulant influence of the calomel on the orifice of the common duct, brings them down from the bladder into the duct. But were this the case, other purgatives, which also stimulate the gall-ducts in their passage through the duodenum, should produce the same effect; which, however, is not the case. I have had no opportunity of convincing myself, by post-mortem examination, of the existence of calculi in such cases; but I am inclined to think that this effect of calomel depends upon some other cause not yet ascertained.

The whole genus of Cathartics has been employed for the expulsion of worms from the intestinal canal. They are well adapted for removing these parasites when they are destroyed or detached from the coats of the bowels by other means: but the continued use of Cathartics is more likely to foster worms than destroy them, by weakening the bowels and increasing the quantity of the nidus in which they are formed; by favouring a morbid condition of the ordinary mucus of the intestines.

In all chronic diseases, Cathartics are useful. It is almost unnecessary to speak of their utility for regulating those natural and diurnal discharges from the intestines requisite for preserving the ordinary state of health. There is great diversity in the frequency of the evacuation which is required in a state of health in different individuals. We read of persons who have continued to enjoy health, although they have passed weeks, months, and even years, without an alvine discharge. Many of these cases are recorded in Haller's Physiology: in Heberden's Commentaries, mention is made of a person who had a motion once a month only;

and of another who had twelve motions daily for thirty years; and then seven every day for seven years—" neque," adds the distinguished narrator, " vir hic interia macuerat, quin potius aliquanto habitior factus erat.*" But the most remarkable case on record, is one of abstinence in a young lady, mentioned by Ponteau, who had no stool for upwards of eight years ; yet, during the last year, she ate abundantly of fruit, and drank broth, with yolks of eggs, coffee, milk, and tea. But these are peculiar cases. The daily evacuation of the bowels is generally requisite for the preservation of health ; and, when this is interrupted, head-ache, vertigo, a sense of weight at the epigastrium, nausea, fœtid breath, and other symptoms indicative of derangement of the digestive organs and abdominal viscera take place ; and, when long-continued, these symptoms are followed by emaciations. In such cases, courses of mild purgatives, upon the plan pointed out by Mr. Abernethy, are particularly indicated: besides clearing out the bowels daily, the secretions are improved, particularly those of the liver; and all the functions of the stomach and intestines are gradually brought into a healthy state. In those instances of irregular bowels of this kind, which have come under my notice, I have found the Rochelle Salts, in combination with carbonate of soda, taken in a state of effervescence with lemon juice, to answer better, and to clear the loaded tongue more rapidly, than the draught with infusion of senna usually prescribed by Mr. Abernethy. Besides being more efficacious, this is a much more agreeable medicine.

When costiveness is accompanied with griping, arising from spasmodic constrictions, the disease is *Colic ;* when with twisting about the umbilical region, with acute pain, it is *Ileus.* In both cases, Cathartics, combined with opiates, are the remedies to be relied on. In some modifications of this state, particularly that which is termed painters' colic and dry belly-ache, castor oil is regarded almost as a specific. In violent cases of ileus, all the ordinary Cathartics fail; in this extremity, injections of turpentine and of infusion of tobacco

* Commentarii de Morb. Hist. cap. v.

have been employed; administering, at the same time, mild purgatives combined with narcotics, especially henbane, by the mouth; and, when these fail, the patient has been relieved by being taken out of bed and cold water suddenly dashed upon his extremities. It is scarcely necessary to notice the absurdity of prescribing mercury in its metallic form, balls of gold and silver, and other mechanical means, which have occasionally been resorted to for overcoming the constriction of the bowels in such cases. The practice is worse than useless.

In the event of intusception, or the strangulation of the gut, from one portion of it slipping within another, I have already mentioned that injections, forcibly thrown into the intestines from the rectum, are the only rational means of relief. Dr. Haen practised this plan successfully. He employed water only, and invented a machine, which may be regarded as the original of the stomach pump, for effecting this purpose. I have employed the stomach pump successfully in two instances. In order to secure success, however, the injections must be employed before inflammation of the strangulated portion of gut has continued long enough for coagulable lymph to be thrown out, and cohesion to take place. When this occurs, no human means are effectual for the removal of the obstruction; gangrene supervenes, and death ensues.

In concluding the consideration of this part of my subject, I need not advert to its importance, and the great value of the tribe of medicines which produce a Cathartic effect on the body. In all diseases, they form most useful auxiliaries to other medicines. The number of Cathartics retained in the British Pharmacopœias is greatly less than formerly; but the list is still too extensive: the pruning knife, however, must be applied with caution; and it is only when the facilities for extensive clinical observations are within our power that we can determine the absolute worth of any medicine.

SECTION XV.

DIURETICS—MEDICAMENTA DIURETICA*.

DIURETICS are usually defined, "medicines which augment the urinary discharge." This definition is correct in the general terms in which it states the effect of *Diuretics* on the body; but it does not convey any idea of the manner in which they operate, nor describe, nor point out, any organ upon which their influence is exerted to produce the effect it denotes. It might thus be considered defective, as being too general; but it is the only one that can be admitted: for the excretion of urine, under the influence of Diuretics, does not always arise from a direct application of the diuretic substances to the kidneys; but from circumstances connected with the state of the stomach and other organs, under which the kidneys act only a secondary part.

Diuretics are supposed to operate in four distinct ways: 1. By passing into the circulation, and being conveyed to the kidneys without undergoing any decomposition in *transitu*, acting directly as stimulants to the urinary organs. 2. By suffering decomposition in *transitu*, and aiding, by one or more of their constituents, the secretion of the urine. 3. By acting primarily on the stomach and primæ viæ, communicating their action, by sympathy, to the kidneys. 4. By stimulating the disordered capillaries to more healthy action, thereby preventing the undue effusion of fluids into the serous cavities, and enabling the absorbents to carry back those already effused into the circulation, to be discharged by their natural excretories, the kidneys. To understand these methods of action, it is requisite that we should have a correct knowledge of the structure and functions of the kidney.

In the longitudinally divided kidney, the organ displays two parts: one exterior, or, as it is termed, *Cortical;* the other interior, or *Medullary.* The secreting part of the organ is situated in the cortical part, and consists of small vessels arising from the sides of the capillary arteries and running into vascular glomerules, hanging from them like granules from

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* From διὰ and οὐρέω.

stalks: from these arterial glomerules spring minute, colourless, secreting vessels, and also the radicles of veins, for conveying back, into the venous trunks, the blood, after it has been deprived of the secreted fluid. The secreting ducts terminate in the excreting tubes; which, pursuing a straight course through the medullary substance, coalesce into a few trunks, the open mouths of which perforate the papillæ in the pelvis of the organ. Each of these papillæ corresponds to an original lobe of the kidney, and conveys the urine secreted in that lobe into its infundibulum: the union of these infundibula forms one large membranous cavity or pelvis, which, as I stated before, terminates in the ureter.

1. Now, the blood sent to the kidney passes through the glomerule in innumerable streams, and supplies the pabulum from which the urine is secreted. The blood, therefore, is the natural stimulus of the kidneys; and whatever it can take up and convey to these organs must more or less affect this natural function, so as to increase or diminish the discharge of urine. Hence the inquiry, in what manner is this effected?

If we analyse the urine, we find that it consists chiefly of water and urea, a peculiar substance, which is a compound of 28 parts of nitrogen, + 16 of oxygen, + 12 of carbon, + 4 of hydrogen; and thence the kidneys have been regarded as the great outlet for nitrogen from the system.

The urea, the largest component, if we except the water, is separated from urine by evaporating that fluid and acting upon it by alcohol, which dissolves the urea; and then evaporating till it crystallizes; or it may be detected by evaporating urine to the consistence of a syrup, and pouring into it concentrated nitric acid, which, combining with the urea, forms shining crystals, closely resembling that of boracic acid. There are two free acids supposed to be present in healthy urine: one, which is the cause of fresh urine reddening litmus, is the *Lactic;* the other, which appears sometimes in red crystals, is the *Uric:* but, instead of free acid, Dr. Prout regards the former of these effects to be produced a supersalt,—the superurate of ammonia. It is astonishing how small a quantity of animal mucus and albumen can be detected in healthy urine. Infusion of gall-nuts precipitates albumen: and, in some dis-

eases—in dropsy, for example—the quantity of this component is so great, that it may be detected by merely heating the urine, which coagulates both by heat and acids when it contains much albumen: and, in some instances, it has spontaneously coagulated within the bladder. But, besides these principal components, urine contains sulphates of soda and of potassa; phosphates of soda and of ammonia; muriates of soda and of ammonia; lactate of ammonia, with a trace of fluate of lime and siliceous earth. Knowing that these are the components of urine, it is not difficult to ascertain what substances have passed through the kidneys, and whether these have undergone decomposition. Thus, if free potassa or soda, or nitrate of potassa, be taken into the stomach, so as not to act upon the bowels, and be afterwards found in the urine, we are authorized in concluding that they pass through the blood, and are directly applied to the kidneys, from which they are excreted in solution with the watery part of the urine. The excretion, however, of these salts does not take place until they have stimulated the viscus to an increase of its natural function, and consequently to the formation of more urine than is secreted in the usual state of the organ. It is a curious fact that, although these substances can be detected in the urine, they cannot easily be discovered in the blood, which must carry them to the kidney. Thus, nitre can be readily detected in urine by soaking a piece of paper in the urine and drying it; if nitre be present in the urine, the paper will deflagrate when burnt. Owing to this circumstance, and the facility with which some substances taken into the stomach find their way into the kidney, Sir Everard Home was led to suppose that they pass through the spleen: but he afterwards abandoned the idea; for, on removing the spleen and trying the thoracic duct, the colouring matter of rhubarb, injected into the stomach of a dog, could be detected in the urine, while no trace of rhubarb could be discovered in the lacteals. There is no difficulty in detecting the presence of rhubarb in the urine: if any of the mineral alkalies be added, the same deep colour is produced as when an alkali is added to an infusion of rhubarb largely diluted with simple water. In jaundice, the bile passes again into the blood, and is separated from it in the kidneys, and can

be detected in the urine by muriatic acid causing a green tint. From what has been said, it is sufficiently evident that some substances are conveyed by the blood to the kidneys; and if these are of a nature to stimulate these viscera to increased action, provided this be short of inflammatory excitement, a greater discharge of urine is the consequence. It is this class of substances which occupy the first section of the table. I may here remark, that the excretion of urea by the kidneys seems to be essential to the health of the system. When both kidneys are taken away in a dog, the animal dies before the ninth day: the serosity of the different secreting organs gives traces of the presence of urine in it. It must however be recollected, that, in health, when the kidneys are entire, some of the principles of urine—for instance, *Urea*—is found in the perspiration. There are instances also of persons who have passed no urine for many years together; and Dr. Richardson, in a paper published in the Philosophical Transactions of 1713, mentions the case of a lad of seventeen who had never made any urine, and, nevertheless, suffered no inconvenience.

Besides the evidence of several saline matters passing through the circulation, and being excreted by the kidney unaltered, there is also evidence of some vegetable substances following the same rule—for example, the volatile oils; as those of turpentine, juniper, cajuputi, and cubebs. The odorous principles, also, of garlic and asparagus may be detected in the urine an hour or two after these substances have been swallowed. Water also passes off in this way, and, therefore, the quantity of urine is generally in proportion to the quantity of fluid drank.

With regard to the manner in which the kidney is stimulated to increased action when the blood sent to it contains saline and other substances, which, having been taken into the stomach, are found in the urine, it is obvious that their action must be within a certain limit; for, were the excitement of the kidney sufficient to induce inflammatory action, the urine, instead of being augmented in quantity, would be scanty and high coloured—a fact of great practical importance.

Much of the fluid ingesta passes off by the kidneys, and

the quantity of urine excreted is generally proportionate to the quantity of fluid taken into the stomach; thence the necessity of dilution to promote the operation of diuretics.

None of the substances possessing diuretic properties require the addition of dilution so much as those which pass undecomposed into the blood. Without this they would scarcely be conveyed to the kidneys; and, if they were, the over-excitement which would be induced, would check rather than promote the increase of the urinary discharge.

The action of diuretics is, also, much modified by the function of the skin. When a diuretic is administered, the surface should be kept cool; for, if the cutaneous exhalants be stimulated by heat, the action of the medicine is determined to the surface by that law of the system which regulates the balance between the skin and the kidneys as excretories; and sweating supervenes with a diminished discharge of urine: just as, in the healthy state, in cold weather when the surface is chilled, the quantity of urine is abundant and pale; whilst, in hot weather, when perspiration flows freely, the urine is scanty and high coloured. On this account, the season of the year, clothing, and all circumstances influencing the function of the skin, modify the operation of direct diuretics.

2. Many vegetable and also some saline bodies undergo digestion to a certain extent, and only one or more of their constituents reach the kidneys: and it is a curious fact that the salts which undergo decomposition in transitu are those into which the vegetable acids enter as components. These acids, in their free state, are extremely prone to decomposition; and it would seem that the power by which this is effected, in the stomach and intestines, is also sufficient to separate them from the alkalies with which they are united. The acid thus separated is decomposed, whilst the alkali is taken into the circulation, is conveyed undecomposed to the kidneys, and excites that action in it which promotes the secretion and excretion of the urine. This remark, however, does not generally apply: for some salts, compounds of vegetable acids with alkalies—bitartrate of potassa, for instance—operate in a manner which cannot be explained upon

the supposition that its alkali only is conveyed to the kidneys. The mineral acids also, being less prone to decomposition, are not separated; and, owing to this circumstance, their neutral salts act as direct diuretics. Dr. Paris seems inclined to believe that the *bitter principle* is the active ingredient of the vegetable diuretics, which are decomposed by the digestive organs*. I am not prepared to deny the accuracy of this opinion; but, if we may reason from analogy, I should be disposed to ascribe the effect to some alkaline principle, which it is probable all of them contain. That other principles of vegetable bodies are separated during digestion and determined to the kidneys, is evident from the odour which asparagus, garlic, and some other vegetable aliments impart to the urine; and, as these substances are in some degree diuretic, it is not improbable that they possess this quality from the principle, whatever it is, which affords the odorous matter.

Salts containing vegetable acids, which undergo decomposition in the digestive process, are more diuretic, in proportion as they are more susceptible of decomposition, than those salts which contain the same acids in proportions only to neutralize the alkalies with which they are united. Thus the bitartrate of potassa is diuretic, whilst the neutral tartrate has no effect whatever upon the kidneys. Besides, as Dr. Paris very justly remarks, "the diuretic operation of any body that acts by being absorbed, is at once suspended if Catharsis follows its administration;" owing to the law of the œconomy, "that the processes of assimilation and absorption are very imperfectly performed or altogether arrested during any alvine excitement." Something, however, is due to the extent of the dose of the substance employed; seeing that many substances, within certain limits, as regards the doses in which they are given, operate as diuretics, but, beyond these limits, as Cathartics: thus, the bitartrate of potassa in large doses purges; in small, stimulates powerfully the kidneys: oil of turpentine, in doses of from ten or fifteen minims to a fluid drachm, stimulates the kidneys so powerfully as to cause bloody urine; yet, if a fluid ounce be ad-

* Pharmacologia.

ministered, no effect is perceptible on the urinary organs; and in the same manner, when nitrate of potassa has been taken by mistake for sulphate of magnesia, to the extent of an ounce for a dose, the symptoms do not indicate any action upon the kidneys.

Those substances which increase the flow of urine, without acting immediately upon the kidneys, are substances diminishing arterial action, and augmenting that of the capillaries. It is a well-known fact, that, if Digitalis be given while the habit is labouring under a state of inflammatory excitement, it produces little or no effect on the kidneys; but if this excitement be previously reduced, the influence of the remedy becomes quickly obvious by the increased flow of urine. Indeed, experience daily demonstrates the activity of this diuretic in weakened habits, if the debility have not proceeded too far; and, also, how imperfectly it operates when the system is under the influence of febrile excitement. Thence the necessity of watching, attentively, the state of the system during the employment of diuretics, to regulate it so as to obtain their full influence; and, if the excitement continue, to intermit the use of the diuretic, and have recurrence to venæsection and purging before again administering it.

3. The third description of diuretics, those which operate without acting directly on the kidneys, are substances which augment the nervous energy, give an impulse to the general vigour of the habit, and produce tone. In a weakened condition of the body, the fluids in the serous cavities and cellular tissue accumulate; and when the cutaneous system shares in the general debility, anasarca is the consequence. In such conditions of the body, the employment of bitter vegetables produces a diuretic effect; for the tone of the body being increased, all its natural functions are augmented, and those of the urinary organs in particular, so that an increased flow of urine follows.

4. The last division of Diuretics is intended to demonstrate the manner in which mercury produces diuresis, by its primary action on the capillary system.

Besides these different modes in which diuresis is induced, it is necessary to advert briefly to the influence of

mental affections on the urinary discharge. As I have already stated, whatever suddenly depresses the nervous energy produces diuresis; thence all the depressing passions have this power. Fear has a considerable influence in this respect: various sounds* and even odours operate in the same manner through the medium of the nerves.

Diuretics, from the increased discharge of urine which they induce, operate as evacuants; but at the same time they also exert a stimulant influence.

As evacuants, they remove the general plethoric state of the system, and diminish, also, the excitement of the habit without inducing much debility; for, as the abstraction of the fluid, which they chiefly separate from the circulating mass, is slowly effected, the vessels contract, and gradually adapt themselves to the diminished quantity of their contents. As evacuants, also, Diuretics are supposed to carry off acrimonious matters from the blood; but the existence of such matters in the blood is very doubtful. As stimulants, Diuretics act on the general and the capillary systems, even when they exert a direct action on the kidneys. As far as their effects depend on their stimulant properties, they are contraindicated in all inflammatory states of the kidneys; in which states, and where much irritability is present, the simple diluent Diuretics are to be preferred. Water is the best of these: how far it acts a part in the operation of all Diuretics is not accurately known; but it has undoubtedly a considerable influence in modifying their effects.

On account of the necessity there is for keeping the surface cool during the operation of Diuretics, the day time is to be chosen for administering them; and during their action the patient should, if possible, be kept out of bed. Their effect is increased by exercise and friction on the surface of the body. Care ought also to be taken, in selecting the diuretic substances, to ascertain which description of those usually

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* Shakspeare, who allowed nothing to escape his notice, remarks, in the person of Shylock,—

> And others, when the bagpipe sings i' the nose,
> Cannot contain their urine: for affection,
> Masterless passion, sways us to the mood
> Of what it likes or loaths.—*Merchant of Venice.*

employed is best fitted for the case: to reduce the arterial action, by bleeding and other means, rather below the natural standard, before administering Diuretics; but never to bleed or purge during their actual operation; and, when full diuresis is desired, to administer freely diluent drinks.

TABLE OF DIURETICS.

A. DIRECT DIURETICS.

1.—not undergoing decomposition in transitu.

* *Organic Products.*

a.—VOLATILE OIL—uncombined, obtained from

Pinus *Larix*	21 . 6 .	Coniferæ.
—— *Sylvestris*	21 . 6 .	———
Melaleuca *Cajuputi*	12 . 1 .	Myrtaceæ.
Juniperus *communis*	22 . 8 .	Coniferæ.

* * *Inorganic Substances.*

b.—IODINE—*Iodinum.*

c.—POTASSA—*Potassa.*

d.—DILUTED MINERAL ACIDS. *Acida Mineralia diluta.*

e.—SALTS.

Muriate of Baryta, *Barytæ Murias.*
Nitrate of Potassa, *Potassæ Nitras.*
Chlorate of Potassa, *Potassæ Chloras.*

2.—undergoing decomposition in transitu.

* *Organic Products.*

Animal.

f.—CANTHARIDEN, procured from

Cantharis *vesicatoria*	4 . 5 .	Insecta, Coleoptera.
Mylabris *variabilis*	— — ——	——

Vegetable.

g.—OLEO-RESINS—obtained from

Copaiferæ *Balsamum.*
Piperis *Cubebæ* baccæ.
Juniperi *communis* baccæ.
Diosma *crenata.* 5 . 1 . Diosmeæ.

h.—VERATRIA—obtained from

Colchicum *autumnalis.*

i.—SCILLITINA—procured from

Scilla *Maritima.*

k.—UNKNOWN PRINCIPLES—contained in

Roots.—	Smilax *Sarsaparilla.*	22 . 6 .	Smilaceæ.
	Polygala *Senega.*	17 . 3 .	Polygaleæ.
Leaves.—	Chimaphila *Corymbosa.*	10 . 1 .	Pyrolaceæ.
Twigs.—	Spartium *Scoparium.*	10 . 4 .	Leguminosæ.

* * *Inorganic Substances.*

l.—ACIDS.

Carbonic Acid.	*Carbonicum Acidum.*
Tartaric Acid.	*Tartaricum Acidum.*
Citric Acid.	*Citricum Acidum.*

m.—SALTS.

Carbonate of Potassa.	*Potassæ Carbonas.*
Bicarbonate of Potassa.	——— *Bicarbonas.*
Acetate of Potassa.	——— *Acetas.*
Citrate of Potassa.	——— *Citras.*
Bitartrate of Potassa.	——— *Bitartras.*
Carbonate of Soda.	*Sodæ Carbonas.*
Bicarbonate of Soda.	——— *Bicarbonas.*
Biborate of Soda	——— *Biboras.*

B. INDIRECT DURETICS.

1.—operating through the Vascular System.

* *Organic Products.*

n.—NICOTINA, in

Leaves—Nicotiana *Tabacum.* 5 . 1 . Solaneæ.

o.—DIGITALIA, in
Leaves—Digitalis *purpurea*. 15 . 1 . Scrophularineæ.

p.—LACTUCARIUM, obtained from
Lactuca *Sativa*. 19 . 2 . Compositæ.
——— *Virosa*. 19 . 2 . ———

* * *Inorganic Substances.*

q.—MURIATE OF IRON. *Ferri Murias.*

r.—SPIRIT OF NITRIC ETHER. *Etheris Nitrici Spiritus.*

s.—ALCOHOLIC SPIRITS. *Alcohol dilutum.*

2.—augmenting the general tone of the habit.

t.—BITTER VEGETABLES. *Vegetabilia Amara.*

3.—acting primarily on the capillaries.

u.—MERCURIALS. *Hydrargyri preparationes.*

A. DIRECT DIURETICS.

ORGANIC PRODUCTS WHICH DO NOT UNDERGO DECOMPOSITION IN TRANSITU.

a. VOLATILE OIL.

1. OIL OF TURPENTINE, from whichever of the species of Pinus it is procured, or in whatever manner it be introduced into the habit, rapidly displays its presence in the urine, by the odour of violets which it communicates to that secretion. Thence, it may be concluded that it stimulates the kidneys locally: its effects, however, are greatly influenced by the extent of the dose;—in small doses, it passes to the kidneys; in larger, it operates upon the intestines and the nervous system.

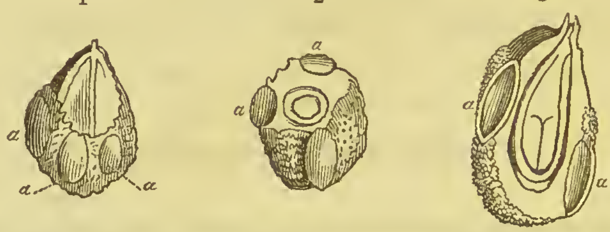
Owing to idiosyncracy, in some individuals, Oil of Turpentine produces a cutaneous eruption, resembling that which is sometimes produced, in hysterical habits of body, by mercu-

rial preparations. When such an eczematous eruption occurs during the use of Oil of Turpentine, the remedy should be instantly discontinued. During its employment, neither wine nor spirits should be indulged in, and the ordinary quantity of food should be diminished.

2. CAJUPUTI OIL, which has been already described (vol. i, p. 184), possesses the same diuretic properties as the Oil of Turpentine, and sometimes produces the same eczematous rash.

3. OIL OF JUNIPER, *Oleum Juniperi*, L. E. D., has also, in many respects, a close affinity to the Oil of Turpentine. It is procured from the fruit of the Juniperus *communis**, the enclosed nut of which is not unlike a small acorn, and is surrounded at its base with three or four glandular vesicles, which secrete the oil. *a*, *a*, *a*, fig. 1, display these entire and largely magnified; *a*, *a*, fig. 2, shew them in a transverse section of the nut; *a*, *a*, fig. 3, in a longitudinal section. The plant,

1 2 3



which belongs to the natural order Coniferæ, is found in most parts of Europe, growing on heaths and hills. It is a thick evergreen shrub. The greater part, however, of the Juniper berries, as the fruit is termed, are imported into this country. Those brought from Italy are preferred to those from Germany and Holland, on account of their superior succulence and plumpness. Both water and alcohol bring over, in distillation, the volatile Oil of Juniper; but not unless the fruit is well bruised, so as to open the vesicles which contain the volatile oil. When properly treated, the oil obtained by distillation is green, has the odour of turpentine, and a hot pungent taste.

Juniper has long been employed to excite the action of the

* Woodville's Med. Bot. 3rd edition, p. 13, pl. 6. London Dispensatory, art. Juniperus.

kidneys in hydropic affections. The oil, in the same manner as that of turpentine, is carried into the blood and conveyed undecomposed to the kidneys, where it is excreted with the increased flow of urine. As the whole of the plant yields this volatile oil, the extremities of the shoots, or the tops of the Juniper, as they are termed, are as diuretic as the fruit; but, the mucous and saccharine matter not being present in them, the decoction of the tops is more nauseous, and, therefore, less frequently employed than that of the fruit.

The fruit of the Juniper is sometimes given in substance, triturated with sugar or with bitartrate of potassa; but it is more diuretic when employed in the form of decoction. The spirituous solution of the oil, or rather a spirit flavoured with the oil, by being rectified with the fruit, *Hollands*, is frequently and advantageously added to the decoction. What is termed Gin, in this country, was originally an imitation of Hollands, and was also rectified from Juniper; but the greater part of the gin now used is made from Scoth and Irish whiskey rectified on turpentine. If the spirit were good, the English gin is a better Diuretic than Hollands, in as much as the Oil of Turpentine is a superior Diuretic to the Oil of Juniper. The oil may be given combined with sugar, as an oleo-saccharine compound; and, when this is diluted with any bland fluid—as, for instance, emulsion of almonds—it is the best mode of administering this Diuretic.

All of these oils are employed to excite the action of the kidneys; but, in effecting this, they probably also influence generally the capillary system. The Oil of Turpentine is the most useful of the three.

* * INORGANIC DIURETICS WHICH DO NOT UNDERGO DECOMPOSITION IN TRANSITU.

b. IODINE, *Iodinum.*—The nature of this elementary substance has been already explained (vol. i, p. 138). I have only to add here, that it is sometimes adulterated with plumbago and other things. The quantity of the plumbago can be readily ascertained, by volatilizing a given portion of the suspected specimen and weighing the residue. Besides uniting with mercury and lead, to form the metallic iodides which

have been described under the head of Excitants, it also forms an iodide with potassium.

In combining with potassium, it explodes during the union; the heat which is developed volatilizing the compound: but when it is condensed, it assumes a crystalline form. It consists of 100 parts of potassium + 319 of iodine. When thrown into water, it forms hydriodate of potassa, owing to the decomposition of the water. It also readily and spontaneously combines with phosphorus, extricating much heat, but no visible light, unless the union be made in the open air.

As a Diuretic, Iodine is given in alcoholic solution, or tincture. When administered, internally, in doses of from ten to thirty drops in a glass of water, twice or thrice a day, this tincture stimulates very powerfully the whole of the glandular system, and, in a special manner, the kidneys. This renders it a most useful remedy in ascites, connected with diseased states of the liver and the mesenteric glands. Dr. Baron of Gloucester succeeded in curing that disease by its means; and I believe a case has also proved successful in the hands of Dr. James Johnson. I have taken advantage of this decided effect upon the capillary system to render Iodine beneficial in the treatment of organic disease. In one case of ovarian dropsy, the Tincture was administered immediately after tapping, in conjunction with mercury, three times a day, in doses gradually extended to sixty minims: under its use the swelling disappeared, and health was restored. In this instance, it is probable that the great advantage arose from the rapidity with which the Iodine was thrown into the habit after the tapping, and whilst the flaccid sac remained as a kind of extraneous body in the abdomen. It has never proved beneficial in similar cases when administered during the turgidity of the ovarian tumor, the growth of which seems to depend on the local action of its own vessels, and to be scarcely influenced by the general system. The state of tension, therefore, being the natural state of the ovarian tumor, it is, when in this state, beyond the sphere of action of agents affecting the general system: but, when the fluid is discharged, it is then brought within the sphere of such action, and the Iodine operates beneficially. In some other cases, which have been treated in the same manner, although a cure has not been ef-

fected, yet the period for tapping has been greatly protracted: for instance, in one case from ten weeks to six months. Like foxglove, it does not act beneficially when the abdomen is tense; but, after tapping and reducing the excitement by blood-letting, it rapidly displays its influence on the kidneys. It is the only substance which seems to stimulate decidedly the absorbents; and their influence, when thus urged, extends even to the healthy glands: both the mammæ and the testicles, free from disease, have, in several instances, nearly disappeared during its administration.

The Tincture has also succeeded in reducing enlargements of the liver when other means, even mercury in its varied forms of preparation, had failed. It not only removes the obstructing matter of the diseased glands, reducing them, but sometimes, as already stated, it acts also on the healthy glands. Its influence in bronchocele and other enlarged glands, whether of a scrophulous or an incipient scirrhous nature, has been well authenticated. Out of 109 cases of scrophula treated by M. Lugol at the Hôpital St. Louis, in seventeen months, 26 were completely cured, 30 greatly benefited, 4 not improved, and 39 under cure when the report was made. Iodine only was given internally, and externally applied.

Some inconveniences arise from its employment in irritable habits. It causes a febrile state, often accompanied with nausea, vertigo, and headache; and, occasionally, with dysenteric symptoms. In some respects the symptoms resemble those of paralysis agitans, shaking palsy; sometimes it excites profuse perspirations; and griping pains of the stomach and bowels. When these occur, the use of the medicine must be suspended.

A milder preparation, and rather more diuretic than either the pure Iodine or the tincture, is the HYDRIODATE OF POTASSA. A formula for preparing this salt is now contained in the Dublin Pharmacopœia, and in the London Dispensatory. The simplest method is to add Iodine to hydrosulphate of potassa until the potassa is saturated, and the sulphur falls.

Hydriodate of potassa is in small irregular cubes, not unlike those of common salt. It may be given in solution, being very deliquescent and soluble. The dose of the saturated solution is from ten drops to thirty: but it has hitherto

been seldom given internally, although frequently employed externally, in conjunction with lard, as an ointment for the discussion of scrophulous tumours. It aids the solution of Iodine in water, and on this account it is given in combination with Iodine in aqueous fluids. M. Lugol's formula is of Iodine gr. i¼, Hydriodate of potassa gr. iiss, and distilled water f℥viii. One-fourth part of this solution is to be administered, in divided doses, in the course of the day. M. Lugol forms a bath also of Iodine by similar means—three parts of Iodine, and six of hydriodate of potassa are dissolved in 3000 parts of water. M. Lugol has employed this bath successfully in scrophula.

Adulterations. When Hydriodate of potassa is adulterated with bicarbonate of potassa, the fraud may be detected by adding lime water, then muriate of baryta, and sulphate of magnesia; a white precipitate is produced, soluble in muriatic acid, if the carbonate be present. If we suspect muriate of soda, add solution of nitrate of silver; and, to the yellow precipitate produced, add excess of ammonia, and stir the mixture: after some time, filter, and add a little nitric acid; if a muriate is present, a white precipitate will fall. The rationale is this—the nitrate of silver precipitates the hydriodate: the precipitate is insoluble in ammonia, being an iodide of silver; but the muriates are soluble in ammonia: the addition of the acid, taking away part of the ammonia, allows a chloride of silver to be precipitated. The hydriodate of potassa is incompatible in prescriptions with salts of copper, of lead, of mercury, and nitrate of silver.

Both these preparations of Iodine, as well as pure Iodine, exert a decided influence in softening and removing bronchoceles, and scrophulous tumours; but when febrile symptoms, cough, and nervous irritability occur, such as I have already noticed as requiring the medicine to be discontinued, it is then productive of much danger to many habits. In its administration, therefore, the attention of the physician to the general state of the patient should be close and unremitting.

The dose of the Tincture of Iodine is from m. x, gradually carried to m. xl: that of a saturated solution of the hydriodate may extend from m. xx to f℥i, in any bland fluid: and that of Lugol's formula, f℥ss in any bland fluid, four times a day.

c. POTASSA. *Potassa.* L. E. D.—The only oxide which has a diuretic influence is that of Potassium,—*Potassa.* This oxide is formed when Potassium is thrown into water, owing to the decomposition of the water by the metal. For medicinal purposes, however, Potassa is not produced by the immediate oxidizement of the metal: but, by the decomposition of the subcarbonate, by means of quick-lime, the lime attracting the carbonic acid, and leaving the potassa in a free state. When lime is employed to produce this effect, it must be in a state of admixture in water, and the alkali in a state of solution; so that, in order to procure the Potassa in the solid form, evaporation must be resorted to; and, when this is properly performed, the salt is obtained in a crystallized state. Pure Potassa, is a brittle substance, of a white colour, with a peculiar odour, and an extremely acrid taste. In this state, it is pure enough for medicinal purposes: but, to free it from every other salt, it must be dissolved in alcohol, which takes up the pure Potassa only, and leaves the other salts. It is still combined with a small proportion of water; and is, in truth, a hydrated protoxide of Potassium. According to Berzelius, pure Potassa consists of 20 parts of oxygen and 100 of Potassium; or of 1 prop. of Potassium = 39.15, + 1 prop. of Oxygen = 8, making the equivalent 47.15; but Potassa, as we employ it, is a hydrate, and thence, by the addition of 1 prop. of water, its equivalent will be 56.15. When Potassium unites with its full proportion of oxygen, it acquires a yellow colour; and it is curious that, when this peroxide is put into water, it effervesces, gives out its oxygen, and is converted into Potassa.

Potassa is deliquescent, attracting rapidly the humidity of the atmosphere, and is wholly soluble in half its weight of water. When applied to any part of the animal body, it instantly extinguishes the vitality of the part, destroying its organization, and combines chemically with the dead matter, forming a slough; which, after a time, is thrown off by the living parts beneath and around it. The *Causticum acerrimum* of the British Pharmacopœias is this salt. Pure Potassa fuses at a temperature of 360°, and, at a red heat, is volatilized: it displays all the properties of an alkali, changes

turmeric paper and infusion of rhubarb to brown; restores the solution of litmus reddened by an acid; greens the vegetable reds; and, in combination with acids, forms neutral salts. When exposed to the atmosphere, besides deliquescing, it attracts carbonic acid, and is converted into the carbonate. Potassa is distinguished from lime and baryta by not forming precipitates with carbonic, oxalic, and sulphuric acids; and from soda, by forming a precipitate with tartaric acid. This test is the simplest and the best; but it requires some attention to avoid fallacy. Thus, the precipitate is redissolved if the quantity of the alkali be increased, or if any strong acid be added: but if the precipitate be redissolved by an alkali, the addition of a small quantity of a strong acid will reproduce it. The precipitate is insoluble in an excess of either tartaric or acetic acid.

Such are the chemical properties of Potassa. As it acts as a powerful escharotic when applied to the body, it cannot be administered internally in a solid form; it must be largely diluted with water, or some bland, aqueous fluid. In the form of Liquor Potassæ of the London Pharmacopœia, it may be given in very large doses, if the dose be gradually augmented and sufficiently diluted. This solution, when properly prepared, is limpid, colourless, and void of any odour: it is too acrid and caustic to be tasted alone; and, when rubbed between the fingers, it feels soapy, owing to a solution of the cuticle. Its specific gravity should be 1.056; and one pint of it should weigh sixteen ounces. It ought not to effervesce with acids, nor to render lime-water turbid; but it is seldom prepared for medicinal purposes so free from carbonic acid, nor is this perfection requisite. When it is desirable to free it entirely from carbonic acid, the alkaline solution and the lime should be boiled together.

In its ordinary state, Liquor Potassæ, when given in doses of from ten minims to f℥ss, in a large cupful of water, or of milk, or almond emulsion, or even beer if it be not sour, passes unaltered to the kidney and acts as a Diuretic. When taken into the stomach, however, its primary effect is upon that viscus. If any acid be present, it neutralizes it; and when the dose is sufficiently large to allow the alkali to pre-

dominate, or if no acid be present, it then acts as a sedative upon the stomach, allaying its morbid irritability, and enabling it to secrete the gastric juice more slowly, and consequently in a more healthy state. Its secondary action is upon the kidney, to which it is carried undecomposed; and its passage through which can be detected by testing the urine with infusion of rhubarb or of turmeric. As a Diuretic, Potassa is not extensively employed, owing to a fallacious opinion that it is injurious, if given in doses sufficient to produce its full effect. I have given it to the extent of upwards of 100 drops, three times a day, in psoriasis, without any bad effect; but, on the contrary, with the greatest advantage. It must not, however, be given in such doses at first; but, beginning with ten or fifteen drops, the dose should be gradually increased until the full dose be administered. As soon as it displays its diuretic effects, the influence of the remedy over the disease becomes obvious: but its use must be continued, and the dose as gradually diminished as it was increased, for some time after the disease has disappeared. It is useful in several cutaneous diseases; but as a Diuretic in hydropic affections, it is not much to be depended upon. Its properties as a solvent of urinary calculi shall be noticed in another part of this volume.

d. DILUTED MINERAL ACIDS.

Water acidulated with the mineral acids is a valuable Diuretic. But, although I have placed water, in this state of combination, as a Diuretic which enters the circulation and directly stimulates the kidneys, by the aid of the acid which it contains, yet it is very doubtful whether the mineral acids, undecomposed, pass through the kidneys. In what manner, then, it may be asked, do they aid the diuretic properties of water? I would reply, by their tonic influence promoting the action of the capillaries, and thereby carrying the water more directly into the circulation, so as to throw it upon the kidneys. Be this as it may, if we regard water as the basis of every fluid, there is no difficulty in conceiving the extent of its influence in promoting diuresis. The erroneous idea that drinking large quantities of watery fluids is likely to in-

duce dropsy, is now discarded, since the pathology of that disease has been better understood. Every one knows that where large supplies of water are taken into the stomach, many of the secretions are augmented, and, in a special manner, that of the kidneys. In dropsies, if we observe attentively the operation of Nature to effect a cure, we shall seldom fail to remark that, in as much as thirst is one of the symptoms of dropsy, the free use of fluids is indicated as the curative means in these affections. If the habit be not well supplied with fluid, the secreting vessels of the kidneys are apt to suffer a collapse, and the effused fluid in the cavities is augmented. The beneficial effects of dilution in dropsy was first pointed out by Sir George Baker; and, after him, Sir Francis Milman collected several cases demonstrating the accuracy of the opinions advanced by Sir George Baker, and published them in his Treatise on Dropsy. It, nevertheless, cannot be denied, that, among the cases on record, some of those of ascites cured by it appear to have been cured by an abstinence from drink: but, on the contrary, there are many instances in which ample dilution has been the chief agent in removing the hydropic swellings. It might be supposed that there is much difficulty in deciding between these opposing facts: but so many circumstances occur to modify the function of the kidneys—such as the nature of the medicines employed in conjunction with dilution, the cause and nature of the diseased action which has produced the accumulation of the fluids in the serous cavities, and many incidental events connected with the habits of the patient—that both plans of cure may be prosecuted with an equal certainty of success.

Whatever may be the character of a Diuretic, it is doubtful if it will act on the kidneys without the aid of a large quantity of water or watery fluid taken as drink: and this is especially the case with the saline Diuretics. In hydropic affections, it is of some importance to ascertain how diluents are likely to prove serviceable. If we find that the excretion of urine exceeds the quantity of the liquid ingesta, then we may presume that the fluid taken into the stomach is advantageous: but if the opposite effect takes place, and particularly if the dropsical swelling increases under the use of

ample dilution, the quantity must be diminished, and other means taken to excite the urinary discharge. If the individual be of a languid habit, and if the inflammatory action connected with the effusion of the dropsical accumulation be subdued, then there can be no doubt of the advantageous combination of the mineral acids with the water. Experience has fully demonstrated the efficacy of the combination with these acids; and, therefore, the rationale of their operation, however desirable it may be to know it, is a matter of secondary consequence.

e. SALTS.

1. BARYTA MURIAS. *Muriate of Baryta.* E. D. (vol. i. p. 700).—Although the diuretic influence of this salt has been correctly ascertained, yet it is very seldom prescribed as a diuretic. It has been found serviceable in old worn-out asthmatic habits, in which the disease displays a tendency to terminate in hydrothorax. In such cases, the tonic influence of the muriate maintains the strength of the patient while he is under its diuretic action. The dose of the solution, made with one part of the muriate and three parts of water, is from three to nine minims. It is incompatible in prescriptions with sulphates, citrates, and astringent vegetable infusions or decoctions.

2. NITRATE OF POTASSA. L. E. D. (vol. i, p. 484).—This salt operates first on the stomach as a refrigerant, the effects of which extend to the circulation, and diminishes the force and frequency of the pulse. It passes unchanged to the kidneys, which it stimulates to increased action, augmenting the flow of the urine; and may be detected unchanged in that secretion. The doses in which it is administered, to produce its diuretic effects, are from gr. xv to ʒss; and it requires to be largely diluted.

3. CHLORATE OF POTASSA. *Potassæ Chloras.*—When a stream of Chlorine is passed through a saturated solution of carbonate of Potassa, a partial decomposition of the water takes place, the hydrogen of which attaches itself to one portion of the Chlorine, and forms hydrochloric acid, whilst the oxygen unites with the remainder and forms chloric acid. These acids combine separately with the Potassa, and form

Hydrochlorate of Potassa, which remains in solution in the fluid; and Chlorate of Potassa, which is nearly insoluble, and is obtained in the form of pearl-white, hexhædral, or rhomboidal plates or scales. The nature of the latter of these is already described in vol. i, p. 711.

It is readily decomposed by all the mineral acids, common salt, muriate of baryta, and nitrate of silver, all of which are incompatible with it in prescriptions. As a Diuretic, Chlorate of Potassa operates as a direct stimulant to the kidney, acting nearly in the same manner as nitrate of potassa. It was, at one time, largely employed under the idea of communicating its oxygen to the system, and curing syphilis: but this practice was soon found to be inefficient; and the salt is now seldom employed, even as a Diuretic, to which it has undoubtedly claims on our confidence. It may be given in doses of from gr. v to ℈i, in infusion of broom-tops, or of juniper, or in any bland fluid.

2. DIRECT DIURETICS, UNDERGOING DECOMPOSITION IN TRANSITU.

* *Organic Products.*

a. Animal.

f. CANTHARIDEN.—This substance is procured by a very operose process from the Spanish fly, Cantharis *officinalis*, and the Mylabris *variabilis*. It is a white substance, in minute, micaceous scales, insoluble in water and in cold alcohol; but soluble in boiling alcohol, ether, and oil. The knowledge of its solubility in oil is a fact of much practical importance. The substance has not yet been employed in its free state as a Diuretic, probably from the difficulty of apportioning the dose; but, dissolved in oil, it has been successfully employed as a rubefacient.

The BLISTER BEETLE, Cantharis *officinalis*, from which this principle is procured, is a Coleopterous insect. It is oblong, nearly parallel for two thirds of its length, and then tapering to the extremity. It is about two thirds of an inch long, a quarter of an inch broad, green, shining, and tinted with a golden hue; the wing sheaths are marked

with three longitudinal raised stripes ; the wings are brown, membranous, and transparent. The body is terminated with two small, callous, sharp spines; and the head, which is bent down or gibbous, bears two black, jointed, thread-like feelers. It is of some importance to know the real character of the blister fly, or, more correctly speaking, beetle, as the specimens of them are frequently mixed with the Melolontha and other beetles which do not afford the medicinal properties of the Spanish fly*. It is a curious fact that the circulating, respiratory, and nervous system of this insect, in conjunction with the generative organs, have a singular analogy with those of the vertebrated animals.

The Spanish fly is found in every part of Europe where the vine flourishes naturally, in the open air, that is from the equator to the 52nd degree of northern latitude. It feeds upon the ash, the privet, the lilac, and most of the plants of the natural order Jasmineæ. When it is very abundant, as in some places of France and Spain, an odour resembling that of the mouse is exhaled ; and it is probable that the cause of the ardor urinæ and ophthalmia, experienced by persons who sit under a tree containing many of these insects, during the time of their copulation, is to be attributed to the Canthariden being volatilized, in conjunction with the volatile oil which causes this odour. The ophthalmia is severely felt by those who prepare Canthariden, unless the eyes be protected by gauze shades. The quantity of this volatile principle is much increased during the copulation of the insects, which terminates in the death of the male, the penis being left in the vulva of the female.

For medicinal purposes, Cantharides are collected in the month of May, the period of their copulation, by shaking them from the trees upon which they settle, and catching them on cloths spread for the purpose; and then killing them by exposure to the vapour of boiling vinegar—a process as ancient as Dioscorides, who describes it. Sometimes they are killed by dipping the cloths on which they

* To those who have time and taste for pursuing inquiries in natural history, I would recommend the perusal of an admirable paper on the Anatomy and Organization of the Blister Beetle, in the *Annales des Sciences Naturelles*, for 1826, accompanied with excellent figures of the parts.

are collected into vinegar and water, after which they are dried by exposure to the sun. During the drying, the insects require to be frequently turned; and if the hands of those who perform this operation be not guarded with gloves, great pain is felt at the neck of the bladder, and strangury and ardor urinæ supervene. When properly dried, Cantharides preserve their active properties for more than thirty years. They are, however, often attacked by a small mite or acarus, which, devouring the soft parts, leaves only the hard parts, or the shell of the insect, thus rendering it nearly inert. The only method to stop the depredations of this parasite is to put a little pyrolignous acid into the bottle containing the Cantharides.

Many experiments were made to determine on what the active principle of the insect depends. Dr. Zeer ascertained, from experiment, that the ovaries, the external genitals, and the intestines of the Cantharis contain the most active matter for blistering; the muscular parts, the thorax, and the exterior parts of the body contain much less; the wing sheaths, the antennæ, and the feet, the smallest quantity, but still some. This accounts for blistering plaster thick with the bright green elytra proving almost inert.

Thouvenel, in 1778, first endeavoured to ascertain the nature of the active principle of this insect by chemical analysis. He treated the entire insect with water, alcohol, and ether, submitting each infusion and tincture separately to the press. He obtained—1. one half of the weight of the insect of a parenchymatous matter, which he did not examine: 2, three eighths of a reddish-yellow extract, very bitter, and affording, when distilled, an acid liquor; 3, a concrete yellow matter, which he compared to the pollen of flowers; 4. one tenth of green, waxy, concrete oil, which smelt strongly of the insect, and yielded, when distilled, a sharp, acrid, thick oil. Thouvenel conceived this to be the active principle of the insect.

In 1803, Beaupoil extended the analysis of Thouvenel: he found that the acid of the parenchymatous matter is the *phosphoric*. On submitting the precipitate, which falls, in an aqueous infusion of the insects exposed to the air, to the separate action of alcohol and ether, he obtained a black, gluey

matter, insoluble in alcohol, which blistered without effecting the urinary organs, and a yellow matter very soluble in alcohol, which did not blister unless united with the wax, but produced virulent poisonous effects when introduced into the circulation.

In 1810, a new analysis was undertaken by Robiquet. He boiled slightly bruised Cantharides in distilled water, and obtained a brownish-red solution, which reddened litmus, and was highly vesicant. By repeated boilings, he obtained all the matter of the insect soluble in water. The residue, after being dried, was treated with alcohol, and afforded a green tincture, which, when evaporated in the air, left a green, inert oil, proving that Thouvenel was mistaken in attributing the active principle to this oil. On evaporating the aqueous decoction and treating the residue with alcohol, he obtained a black *insoluble* matter and a yellow *soluble* matter. The black matter was not vesicant, the yellow powerfully vesicant. On treating this yellow matter with ether, he obtained small micaceous crystalline plates, which he ascertained to be most powerfully vesicant when dissolved in fixed oil. This principle, which he regarded justly as the active part of the insect, has been named *Cantharidin* by Dr. Thomas Thomson. Besides Cantharidin, Robiquet found that the insect in its recent state contains a little uric acid, acetic acid, phosphate of lime, and magnesia, forming the bases of the horny parts; and a concrete fixed oil, besides the volatile oil, which Orfila states is combined with the Cantharidin, and aids its medicinal powers.

The diuretic properties of Spanish flies were known to the ancients, Hippocrates having often prescribed them in dropsy and amenorrhœa. A very celebrated Diuretic, also, of Tulpius consisted of a tincture of Spanish flies, tincture of Cardamoms, and sweet spirit of nitre. The effects of this insect upon the urinary organs were also very generally known in oriental countries and in the south of Europe as an *aphrodisiac;* but, unless they were employed with the greatest caution, the voluptuary who swallowed the powder bought his momentary gratification by pains and suffering of a very acute description. It was probable that the violence of these

results of the internal use of Cantharides tended to prevent it from being much employed as a Diuretic.

When Cantharides are taken into the stomach, they are partially digested, and perhaps the Cantharidin is the only part of the insect received into the circulation. But whether it be this principle, or the entire matter of the insect, in minute division, that is absorbed into the blood and conveyed to the kidneys, its influence upon these organs is stimulant; and when it is incautiously administered, this amounts to acute inflammatory action, producing bloody urine, insupportable pains in the abdomen, strangury, vomitings, convulsions, delirium; and frequently the issue is fatal. When Cantharides, however, are administered in proper doses, namely, not exceeding one or two grains, they stimulate the kidneys and cause an increased flow of urine. Cantharides, besides forming the celebrated lithontriptic of Tulpius which I have noticed, were also long prescribed for the cure of gleets by the Sicilians; yet, in 1693, Dr. Groenvelt was committed to Newgate by a warrant from the president of the College of Physicians, for prescribing them internally. Quincy, in relating this anecdote, adds, that this act, which ruined the unhappy doctor, taught the safety and the value of his practice. The effect of Cantharides is stimulant in the first instance; but this is transitory, and, whilst there is a copious increase of the urinary discharge, neither heat of the kidney nor strangury is experienced. They have been found extremely useful, when administered as a Diuretic, in scaly affections of the skin. But it is probable that this is the result rather of the general stimulus given to the capillary system than to their diuretic powers. They have been employed with success in the ascites of old worn-out constitutions. It is requisite during their employment to dilute freely with bland fluids. If strangury occur, the best mode of relieving it is to throw into the rectum a pint of warm water, containing from twenty to sixty minims of laudanum.

Notwithstanding the safety and advantage with which Cantharides may be internally administered, they cannot be said to be much employed; and indeed when we consider that many individuals suffer considerably, even from the absorp-

tion of such minute portions as can be taken up from a blistering plaster, the danger of an incautious employment of Cantharides internally, when we have so many less injurious Diuretics at our command, is sufficient to set aside their general employment.

When Cantharides have been accidentally taken in large doses, the best mode of counteracting the dangerous symptoms which they induce is to bleed, and to reduce the inflammation which supervenes by copious dilution with bland, demulcent drinks. The use of oil, however, must be carefully avoided; for, as the oil is the best solvent of Cantharіden, the poison is only the more widely diffused, and consequently it is rendered more extensively hurtful. Many of the cases of poisoning by Cantharides recorded by authors have arisen from the poison having been secretly swallowed to excite the venereal appetite; but as, in many cases, this effect has not followed the ordinary dose, large doses have been swallowed. The greater number of the cases detailed by toxicological writers have not terminated fatally, although the sufferings of the patients have been most severe. In some instances, the inflammation of the genital organs has run on to gangrene; which was the case in a fatal instance noticed by Ambrose Paré, which was caused by a young woman seasoning comfits for her lover with Cantharides. In some instances, phrenitic symptoms, with tetanic convulsions and hydrophobia, have been the consequences of overdoses of the tincture of Cantharides.

No antidote is known for Cantharides; and, therefore, the only method of relieving the patient, when poisoned by them, is to empty the stomach with the stomach-pump, and to treat as if the case were one of inflammation of that organ. Of late years, another insect has been introduced into practice, as a substitute for the Cantharides, which appears to possess all its vesicant and diuretic properties. This is a species of the genus *Mylabris*, one species of which, the M. *Chicorii*, a native of the south of France, Italy, and Greece, was employed by the ancients, and is described both by Dioscorides and Pliny. This is the celebrated Buprestis of the Greeks, which was said to be so caustic, that cattle which fed upon

the plants on which the insect alighted died of inflammation; and Pliny says it was used in the same manner as the blister beetle. The genus Mylabris consists of fifty-one species, of which twenty-eight are found in Africa. The species employed as a substitute for Cantharides is the Mylabris *variabilis*. It is brought from China, and is regarded rather as a variety of the M. *Chicorii* than a distinct species. M. Robiquet has analysed it, and has found that it affords Cantharidеn in as great abundance as the Cantharides. I have tried its efficacy as a vesicant, and have found that it acts with as much energy as the best Cantharides. This insect has been long employed, as well as another species of Mylabris, the M. *pustulata* of Olivier, as a vesicant in China. It is considerably cheaper than the Cantharides; and, being also more abundant, its introduction into Europe as a vesicant may be regarded as an advantage. Some species of Meloe, the *Proscarabœus* and *Majalis* in particular, also contain Cantharidеn, and may be used both as vesicants and diuretics. If an easy method of obtaining Cantharidеn were discovered, its use might supersede that of the entire insect.

Vegetable Products.

g. OLEO-RESINS AND VOLATILE OILS.

It is doubtful whether the Oleo-resins pass entire through the kidneys, or whether the volatile oil only, which is undoubtedly the active principle, is separated from the resin by the digestive process, and alone passes into the circulation. The latter is the most probable opinion.

1. COPAIBA. *Copaiferæ Balsamum.* L. E. D.—(See vol. ii, p. 174.) The diuretic properties of Copaiba closely resemble those of turpentine. In moderate doses, it excites the natural functions of the kidney and increases the secretion of urine. In overdoses, Copaiba causes inflammation of the kidneys; consequently its employment should be always avoided when there is the least tendency to ulceration of these organs. Copaiba may be exhibited in either a fluid or a solid state, or its solidification may be effected by means of its combination with an alkali, into a soap, which does not diminish its powers, whilst

it permits it to be formed into pills. The fluid Copaiba may be given in doses of from eight to twenty minims, in water, suspended by means of mucilage. The dose of the soap is from twelve grains to a scruple. The volatile oil, separated from the balsam by distillation, may be formed into an oleosaccharum ; and, in this form, it is preferable to the entire Copaiba. The dose of the oil is from ten to twenty minims.

2. CUBEBA PIPERIS BACCÆ. *Cubebs.* D. (See vol. i, p. 217.) JUNIPERI COMMUNIS BACCÆ. *Juniper Berries.* (Vol. ii, p. 390.) Both of these vegetable productions are partially digested when taken into the stomach ; and the volatile oil which forms their active principle is separated and passes into the blood. Both the volatile oils closely resemble that of turpentine, and therefore it is unnecessary to make any remarks on their chemical properties ; and, with respect to the diuretic powers of the oil of Juniper, my readers are already acquainted with them.

The principal property in which the oil of Cubebs differs from most of the other volatile oils is in the degree of its volatility ; and the escape of the oil, owing to its great volatility, is the cause why the powder of Cubebs so quickly loses its activity : it is indeed so volatile that it can scarcely be preserved in corked bottles.

In moderate doses, Cubebs are diuretic ; in larger, they are purgative. In the former case, the oil can be detected in the urine by the odour, in a manner similar to that of turpentine. The chief disease for the relief of which Cubebs have been employed in this country is gonorrhœa ; but I have occasionally used them in other inflammations of the mucous membrane, and with evident benefit. Thus, in doses of from ten to twenty grains, I have found them useful in chronic inflammation of the mucous membrane of the bladder. In addition to the remarks formerly made (vol. i, page 217) respecting the effects of Cubebs in gonorrhœa, I may add here that some of the benefit is to be ascribed to their increasing greatly the quantity of urine, so as to wash out, as it were, the offending discharge from the urethra. Their beneficial effect evidently arises from the volatile oil entering the circulation, and stimulating, not only the kidneys to increased action, pro-

ducing an augmented secretion of urine, but also passing on to the bladder with the urine so as to stimulate the mucous membrane of the urethra, at the same time that the diseased secretion of that canal is washed out by the great supply of urine. To secure these effects of Cubebs, the pepper should be well preserved in close vessels, and ground or powdered a few hours only before it is administered, so as to retain as much of the oil as possible. It is, for the same reason, more beneficial to administer Cubebs in the form of powder than in that of tincture. To produce the diuretic effects of Cubebs, the dose should exceed half a drachm, and be repeated at moderate intervals; at least four times in twenty-four hours. The distilled oil may be employed in doses of from ten to twenty minims, in the form of an oleo-saccharum.

4. DIOSMÆ CRENATÆ FOLIA. *Buchu Leaves.* D.—The beautiful little plant* yelding these leaves is a native of the Cape of Good Hope, belonging to the natural order Diosmeæ. The leaves are ovate, acute, crenated, dark green on the upper disk, pale on the under side, and studded with small pellucid glands. By the inexperienced eye, they might be mistaken for the leaves of senna: they are generally attached to a small channelled petiole, and are mixed with reddish-brown twigs, mottled near the apex with bright yellow. The leaves exhale a powerful but agreeable aromatic odour, and impart a taste not unlike that of peppermint, leaving a sweetness and pungency on the palate. By distillation, a volatile oil is obtained which has the odour of a mixture of camphor and rue. According to the analysis of M. Felix Cadet de Gassicourt, Buchu leaves contain—6.65 parts of volatile oil, + 21.17 of extractive, + 1.10 chlorophylle, + 2.15 of resin, + lignine 63.63, in 100 parts. The active principles are most probably the oil and resin, which are taken up both by boiling water and proof spirit.

Buchu Leaves have decided diuretic properties, combined with a tonic power which greatly enhances their value. They are administered in the forms of infusion and tincture. The former is made with half an ounce of the leaves and

* Woodville's Medical Botany, third ed. vol. v, p. 52, pl. 13. London Dispensatory, art. Pyrola.

half a pint of boiling water. Ten fluid ounces are given for a dose, which should be repeated every four hours.

h. VERATRIA. (Vol. i, p. 595.)

COLCHICI BULBUS ET SEMINA. *Bulb and Seeds of Colchicum.* L. E. D.—In the same manner as the stomach separates the volatile oil in Cubebs and Juniper, it separates the Veratria from the Colchicum, and the former passes into the circulation and stimulates the kidneys. But Colchicum also purges; which requires some explanation, the action of a Diuretic being at direct variance with that of a purgative: but, although Colchicum in full doses acts powerfully on the duodenum, and brings down a large quantity of bile into the bowels, yet in small doses it is taken into the circulation and operates on the kidney. As a Diuretic, it was long employed in dropsical affections, after its use as a remedy in gout became obsolete. It must however be acknowledged, that, as a Diuretic, Colchicum is much less powerful in its influence upon the kidneys than the Squill—a circumstance depending undoubtedly on its disposition to run off by the bowels. For the purpose of producing diuresis, the best form of giving Colchicum is that of tincture. Alcohol takes up the gallate of Veratria with great readiness. In this state it operates more mildly, and, like the alkaloid, is little soluble in the juices of the stomach; but, when it is combined with vinegar or white wine, the acetic acid, uniting with the Veratria, forms a more soluble salt than the gallate, which readily passes the pylorus and excites the peristaltic action of the intestines.

The seeds and the petals of the flower also contain Veratria, and have been employed for the same diuretic purposes as the bulb. The dose of the bulb, in substance, to produce its diuretic effects, is from three grains to twelve; that of the tincture or the wine from thirty to sixty minims. The diuretic powers of Colchicum are not such as to enable the practitioner to rely, with confidence, on its influence in those diseases in which morbid accumulations of fluid are required to be carried off by the kidneys; and, where it has proved useful, it has had little influence on the intestinal canal.

i. SCILLITINA.

SCILLÆ MARITIMÆ BULBUS. *Squills.* L. E. D.—Squill has been employed as a Diuretic from the earliest antiquity. The Egyptians administered it in dropsies, under the name of the *Eye of Typhon ;* and it is mentioned as an hydropic Diuretic both by Theophrastus and Dioscorides. It is one of the most employed of the Diuretics administered for the cure of dropsy. It is generally given in substance, although seldom alone, being combined with calomel, or the blue pill, or the bitartrate of potassa. If a full dose be given at first, it is apt to excite nausea and vomiting ; it is, therefore, preferable to begin with a small dose—one grain, for example—repeated every sixth or eighth hour, and gradually to increase the dose to six grains, or until some degree of nausea be induced. This effect, however, although useful when Squill is given as an expectorant, is not essential to its operation as a Diuretic; but, as Dr. Murray justly remarks, is a proof of the active state of the remedy.

When Squill is combined with mercury, the excretion of urine is always more rapidly augmented ; but whether this depends on the action of the mercury on the capillary system generally, or whether, by this combination, the Scillitina is more readily separated by the stomach, I will not venture to determine. Calomel is perhaps the best addition to Squill, to promote its full diuretic effect. Cullen recommends the bichloride of mercury; but, as far as my experience extends, every intention is answered by calomel, with much less chance of griping than the bichloride is apt to produce. The advantages of the combination of Squill with mercurials are still greater when the source of the deposition of the fluid in the serous cavities is the obstruction of the liver or any of the abdominal glands. If the Squill purge when combined with mercurials, these must either be altogether discontinued, or the mercurial must be applied in the form of friction ; but this direction is not peculiarly applicable to Squill, as it is a law of the system that purging and diuresis cannot exist at the same time.

In some habits, owing to idiosyncracy, the use of Squill excites an eruption on the skin not unlike nettle-rash or the

inflammation caused by the stings of nettles, accompanied with severe gripings, cold sweats, and occasionally convulsions. When this is the case, the medicine must be discontinued, and cordials with opium exhibited.

The alkaline carbonates, infusion of galls, and sulphate of iron, throw down precipitates in mixtures containing the tincture of Squill. It is probable, from these effects of reagents, that sulphate of iron may prove an antidote when Squills are taken in an over dose; but this is a mere suggestion, requiring to be confirmed by experience. The dose of the Squill, in substance, when well dried, should not exceed eight or ten grains. It is most useful in small doses frequently repeated.

k. PRINCIPLES NOT CORRECTLY ASCERTAINED.

Roots.

ROOT OF SARSAPARILLA. *Smilacis Sarsaparillæ Radix.* L. E. D.—This root has had a greater variety of fate than almost any other substance contained in the list of the Materia Medica, having been sometimes in the highest degree of favour and at other times in the lowest state of degradation as a remedial agent. It is the root of the Smilax *Sarsaparilla*, a plant belonging to the natural order Smilaceæ. The plant is a native of the northern regions of South America and of Virginia. It is said that the best Sarsaparilla grows on the borders of a lake on the north of the Cerra Unturan, not far from Esmeralda.

The Sarsaparilla imported into Britain is named from the places of export. 1. That which is termed *Lisbon* is the produce of Brazil. It is the most esteemed, and consequently brings the highest price in the market. Its epidermis is of a dull red colour, marked with slight longitudinal striæ, and free from radicle fibres. The interior is very white, and seemingly formed entirely of fecula. Its taste is bitterish. 2. The *Jamaica*, which has been lately brought into notice, is a subvariety of the Lisbon*. It is character-

* Mr. Pope, in a paper on Sarsaparilla, published in the 12th volume of the Medico-Chirurgical Transactions, regards it as the uncultivated root of this variety, whilst that which is called Lisbon is the cultivated root of the same variety. It grows on the Spanish main of South America.

ized by a reddish-brown coat, and, when divided longitudinally, has a kind of spongy or farinaceous aspect. It is more bitter and aromatic, and less free from fibres, than the other variety. 3. The Honduras Sarsaparilla is the next in point of estimation. Its characteristics are a dirty brown, sometimes whitish cuticle ; it is usually more fibrous, or throws off radicles in greater abundance, and has a more woody pith, than the two other varieties. 4. The Vera Cruz is more dressed and less fibrous than either of the other two ; but it is less esteemed than any of the varieties.

The roots of Sarsaparilla, whatever may be the variety, are inodorous, and have a bitterish, mucilaginous taste. The efficacious part is the bark, the axis or heart being mere ligneous matter, perfectly inert. The bark or cortical part yields all its soluble matter to cold water, but more readily to boiling water: it is also said to yield it to lime-water and to water saturated with pure potassa.

According to the experiments of Mr. Pope, equal quantities by weight of the different kinds of Sarsaparilla Root, when infused in distilled water, and the solutions filtered through paper, afford the following comparative proportions of hard extract. Each was successively treated with hot and cold water.

The Jamaica afforded......64.
finest Lisbon ....42.
Honduras (finest) 48

When equal quantities of the cortical part, and of the wood, were separately submitted to infusion in boiling distilled water, the proportions were—

Of the bark of the Jamaica......100
the wood of the same......... 20
Of the bark of the Honduras ... 48
the wood of the same......... 24

The watery infusion of Sarsaparilla has a brown colour, and is precipitated by infusion of galls ; but this precipitate is redissolved when the infusion is heated. This infusion is not affected by sulphate of iron, at least not the protosulphate ; but it is precipitated by acetate of lead and nitrate of mercury. Pfaff analyzed Sarsaparilla, and obtained—2 parts of

a balsamic resin, 2.6 of extractive, 3.8 of a substance resembling cinchonia, 2.1 of albumen, 2.9 of water, and 75.7 of woody fibre, in 100 parts: but another chemist, Cannobio, obtained—2.8 of bitter acrid resin, 5.5 of gummy extract, 54.2 of starch, 27.8 only of woody fibre, and 9.7 of loss, in the same quantity of Sarsaparilla. It is not easy to reconcile these discrepancies. An Italian, M. Galileo Pallota, has separated, by a very operose process, an alkaloid substance from Sarsaparilla, which he supposes is the active principle of the root; and he has named it *parillina*. This substance is a white, pulverulent, light, saline body, of an austere, slightly astringent, nauseous taste, with a peculiar odour. It is soluble in hot water, slightly soluble in cold alcohol, but very soluble in hot alcohol: its solution reddens turmeric paper; it forms a sulphate when conjoined with diluted sulphuric acid; but the strong acid decomposed it. It forms neutral salts with the other acids. Another Italian, M. Folchi, has also claimed the discovery of the active principle of Sarsaparilla, which he asserts resides in the woody or central part: he regards it as a vegetable alkali, and has named it *smilacine*. I am very sceptical as to the claims of either. Indeed the difficulties connected with vegetable analysis are almost disheartening to the scientific enquirer.

Sarsaparilla affects the secretion of the kidneys: it is probably partially digested, and sends only the active principle, whatever this may be, to the kidneys; but nothing is known upon this subject. This root was early introduced into notice for the cure of syphilis. In the sixteenth century, Fallopius extolled its powers as preferable to mercury in the cure of the primary symptoms of syphilis. He denominates the cure by Sarsaparilla the royal road to health, the via regia, and condemns the mercurial treatment as harsh and severe: "omnium," says he, "curationem acerbissima." Fallopius did not stand alone in this opinion; but, nevertheless, the medicine fell into disrepute, and was not again brought into notice until the middle of the last century, when Dr. William Hunter and Dr. Fordyce again restored it to favour, but not as a remedy for primary syphilis. Its real utility in this disease has been fixed by Mr. Pearson, who regards it as useful

after a course of mercury, to free the habit from what may be regarded as the sequelæ of such a course; and Mr. Bacot, an authority of considerable weight in every thing relating to syphilis, remarks, that "there is no medicine in the whole materia medica comparable to the Sarsaparilla for the purpose of restoring the tone of the stomach and recruiting the broken-down constitution. It certainly possesses the power of improving the general state of the system, and restoring the vigour of the constitution when broken down either by long-protracted disease or by an extended course of mercury. What part of this benefit is to be attributed to the diuretic influence of the root I will not venture to determine. That beneficial effects result from the use of Sarsaparilla experience has fully demonstrated; but perhaps no medicine that is so frequently ordered is prescribed so much on what are termed empirical principles as Sarsaparilla; neither the active principle of the medicine, nor the mode in which it operates, being yet understood. The parillina of Signor Pallota or the smilacine of Folchi may be the active principles of Sarsaparilla; but neither has, to my knowledge, been yet examined in this country; nor have they attracted much attention even on the Continent. M. Planché stated, in 1824, that he had repeated the experiments of M. Pallota, but had not, at that time, verified all the properties said to belong to the parillina. In the six years which have elapsed since that time, nothing has been done with respect either to Parillina or to Smilacine.

In whatever form Sarsaparilla is administered, it is requisite to give it in large doses: a pint of the decoction, an ounce of the powdered root, and from two scruples to three ounces of the extract, must be taken in the course of the day, and continued for many weeks.

In the preparation of the decoction, much unnecessary maceration and boiling are ordered in the Pharmacopœia. The experiments of Mr. Battley have demonstrated that the bruised root yields up all its active and soluble matter to water at 180° Faht. and therefore much boiling is, to say the least of it, unnecessary. As muriate of baryta holds a place as a diuretic in the table, and is a useful medicine in scrophu-

lous habits, the practitioner might be inclined to order it in combination with the aqueous preparations of Sarsaparilla; but it is said to produce an insoluble precipitate with it, and therefore to be incompatible—an assertion, however, which is incorrect.

The great expense of Sarsaparilla has induced substitutes to be proposed for it. For this purpose, the roots of the Aralia *nudicaulis*, a root indigenous in the United States of America, have been used. They resemble the Lisbon Sarsaparilla in their external characters; but may be distinguished by being marked with purplish dots, and having no ligneous, central part. I have occasionally seen this root mixed with the split Sarsaparilla of the shops. The roots also of the Agave *Cubensis*, which resemble the red Sarsaparilla, and those of the Carex *arenaria*, a species of low-creeping rush, admirably adapted to bind together sandy soil, by the long, matted fibres of its roots, are also sometimes mixed with the specimens of Sarsaparilla. The Smilax *aspera* has been lately introduced.

I have, for some years past, employed Elm Bark in dispensary practice, instead of Sarsaparilla, and have every reason for thinking that it is equally efficacious. Not to load the list of Diuretics, already too large, I have not inserted it in the table; but it produces a decided effect upon the kidneys. Besides *ulmin*, a peculiar principle, which is found in the bark of many trees, Elm Bark contains much carbonate of potassa in combination; and probably a great part of its diuretic effects may depend on the union of the ulmine and the potassa. If the Elm Bark be used instead of Sarsaparilla, in secondary syphilis, and nitric acid be ordered at the same time, it must not be given in the forms of decoction, as it precipitates the ulmin by neutralizing the potassa which holds it in solution. Indeed, it is blowing hot and cold to prescribe any of the acids at the same time with decoction of Elm Bark; but, if the analyses of Sarsaparilla be correct, the same objection to the exhibition of acids with it does not exist.

2. POLYGALÆ SENEGÆ RADIX. *Senega or Rattle-snake*

*Root**. L. E. D.—The plant† which yields this root is a native of North America, belonging to the natural order Polygaleæ. It grows on the sides of hills and in dry woods, in Kentucky, Ohio, and Tennessee. The root is irregularly shaped, contorted, gibbous, and covered with a thick dull-yellowish or greyish bark: it has scarcely any odour; its taste is bitter, pungent, and peculiar. The bark is the active part of the root. Although boiling water extracts its active principle, yet, it is most completely taken up by proof spirit. Water renders the tincture turbid; thence it might be suspected that the active principle is oleo-resin. M. Peschier has procured from it an alkaline principle, which he has named polygalina, and which he asserts exists in the Senega Root, in combination with a new acid which he has named polygalinic; but these opinions require confirmation by additional experiments.

Senega Root is a stimulating Diuretic; and its active principle, whatever it may be, is probably separated in the stomach, absorbed, and acts directly on the kidneys. On account of its influence on the vascular system, it cannot be administered in the first stages of inflammatory diseases. I have found it serviceable in cases of hydrothorax, when it is necessary to uphold the powers of the system during the administration of digitalis.

Senega Root may be given either in substance, in the form of powder, or in decoction. The decoction is made with one ounce of the powdered root and a pint and a half of water, boiled down to a pint; of which from half a fluid ounce to an ounce is a dose for an adult. The dose of the powder is from thirty grains to two scruples. It may be advantageously combined with mercurials.

Leaves.

3. CHIMAPHILÆ UMBELLATA FOLIA. *Leaves of Winter*

* It receives its name from having been long employed by the Senagaroo Indians as a remedy for the bite of the rattle-snake. It was applied externally, and internally administered.

† Woodville's Medical Botany, third ed. pl. 162, p. 452. London Dispensatory, art. Polygala. Barton's Vegetable Materia Medica of the United States, vol. ii, p. 111, pl. 36.

*Green**. Syn. *Pyrola umbellata*. D.—This plant is a native of Europe, North America, and Northern Asia, belonging to the natural order Pyrolaceæ. The leaves, which are the part of the plant chiefly employed, are lanceolate, somewhat wedge-shaped, or narrowed towards the base, deeply serrated, and of a coriaceous texture. According to the analysis of Dr. Wolf, they contain—18 parts of bitter extractive, +20.4 of resin, + 1.38 of tannin, + 77.58 of woody fibre; but, as what is here named extractive burns with a white flame and resinous odour, I am inclined to regard it as an oleo-resin. Both water and alcohol extract the active principle of the leaves. The decoction strikes a deep colour with sulphate of iron. The tincture is rendered scarcely turbid by water.

The diuretic properties of the Chimaphila *umbellata* were known to the Hourons and other Indians long before Europeans employed it; and they have been since well ascertained. It was first used as a remedy in dropsy by Mr. Carter, who was surgeon to the hospital at Fort William, in Canada; and its influence on the capillary system was fully determined by Dr. William Somerville, who gave it a fair trial in the case of Sir James Craig, Governor of Canada, who was labouring under ascites, with a cachectic habit; and the results of that case induced Dr. Marcet, Dr. Satterley, and others, to try its powers. In all cases, its diuretic effects were evident. Besides its diuretic influence, it operates as a tonic, increasing the powers of the stomach: and thus, whilst its value as a diuretic is enhanced, it has a decided advantage over many other Diuretics. The bruised leaves, employed as a topical stimulant, induce vesication and desquamation of the skin: I am, therefore, disposed to think that its diuretic properties depend on some acrid principle which is separated in the stomach and conveyed to the kidneys.

Chimaphila *umbellata* is administered either in the form of infusion or decoction, or in that of extract. The decoction is made by macerating an ounce of the dried plant, which must be cut small, in two pints of cold water, and then boiling the strained fluid down to one pint; of which three fluid ounces

* Barton's Vegetable Materia Medica of the United States, 4to. vol. i, p. 17, pl. 1.

may be given for a dose every six hours. The dose of the extract is from ten to fifteen grains; and this may be repeated every third hour.

SUMMITATES VEL CACUMINÆ SPARTII SCOPARII. *Tops of the common Broom.* L. E.—The Broom is an indigenous shrub, a frequent inhabitant of our dry commons, belonging to the natural order Leguminosæ*. The plant generally rises to about the height of from five to six feet, branching much towards the summit. The lower leaves are ternate, small, and smooth; the upper simple. The flowers are papilionaceous, as the natural order imports, supported on footstalks, in bell-shaped, bilabiate, gaping, purplish calyxes. The anthers are saffron-coloured, the germen villous, and the style bent almost to a circle. The pod or legume is compressed, brown, ciliated, and containing several flat, shining seeds.

The tops of the twigs are the parts of the plant employed. When boiled in water, a clear-brown decoction is obtained, which strikes a blackish or deep-olive tint with the solution of the persulphate of iron, and throws down precipitates with acetate of lead and nitrate of mercury. When the broom tops are burnt, carbonate of potassa is procured from the ashes. These processes throw no light on the active principle of broom.

As a Diuretic, broom-tops have been used by the peasantry from time immemorial. It is probable that they undergo partial decomposition in the stomach. In large doses they operate as a cathartic. I have had no experience of their efficacy under my own inspection; but if the remark of Cullen, that they seldom fail to operate both by stool and urine, be true, they must be regarded as distinct from all other Diuretics.

* * *Inorganic Substances.*

l. ACIDS.

1. CARBONIC ACID. *Acidum Carbonicum.*—This acid is seldom employed in solution in water, except in combination with soda, as soda water; in that state it is found useful in

* Woodville's Med. Bot. third ed. p. 413, pl. 150. London Dispensatory, art. Spartium.

calculous affections and irritable states of the kidneys. It is not easy to determine its diuretic influence; but it probably operates by giving tone to the stomach whilst the alkali is conveyed to the kidneys.

2. Tartaric Acid. *Acidum Tartaricum.* L. E. D.—(Vol. i, p. 481.) As a Diuretic, Tartaric Acid acts powerfully; but in what manner has not been determined, as it cannot be always detected in the urine. Its particular effects being the same as those of the bitartrate of potassa, they shall be noticed under the head of that salt.

2. Citric Acid. *Acidum Citricum.* L. E. D.—(Vol. i, p. 482.) This acid exists ready formed, both in a free and a combined state, in many fruits and vegetable productions, which display diuretic properties. It has been detected in the Squill and the Onion, in the form of citrate of lime, and in the fruit of the Cranberry, Whortleberry, Hep, and most abundantly in the Lemon, in a free state.

Citric acid has little power as a Diuretic in its uncombined state; and neither it nor the tartaric are much employed as Diuretics. There is, nevertheless, sufficient reason for supposing that these acids pass to the kidneys undecomposed; as they have been sometimes detected in the urine of those who have taken them freely. They augment the urinary secretion, when they are administered to remove the tendency to the formation of the ammoniaco-phosphates.

When the kidneys are in such an irritable state as occasionally occurs in fevers and in the phlegmasiæ, these acids, largely diluted, have been found useful. The ancients were well aware of their influence on the kidneys, and distinguished them from other Diuretics by the term *cold diuretics*, from an idea that their effects originated not from any excitement on the kidneys, but, on the contrary, from a cooling or sedative influence on these organs.

m. SALTS.

1. Carbonate of Potassa. *Potassæ Carbonas.* L. E. D. —If a solution of Potassa be exposed to the atmosphere, or if a stream of carbonic acid be passed through the solution, it is converted into the carbonate. But Potassa, when pro-

cured by the combustion of land vegetables, contains a certain proportion of carbonic acid in combination with it: the carbonate, therefore, or as it is inaccurately termed, the subcarbonate, is prepared by merely dissolving impure potash in water, filtering and evaporating the solution to dryness. It is procured in the state of a white, granular salt, deliquescent on exposure to the air, and dissolving entirely in the water which it attracts. Its solubility in alcohol distinguishes it from Potassa. When pure, it consists of potassa 61.57, + carbonic acid 31.43, in 100 parts; or 1 prop. of potassa = 47.15, and 1 prop. of carbonic acid = 22, making the equivalent 69.15; but it contains, also, an indefinite proportion of water.

2. Bicarbonate of Potassa. *Potassæ Bicarbonas.* L. E. D.—If a stream of carbonic acid, extricated from white marble by means of muriatic acid, be passed through a solution of carbonate of Potassa until it is saturated, a carbonate, as it is termed in the Pharmacopœia, or, more correctly speaking, a bicarbonate, is produced. This salt is in large tetrahedral, rhomboidal prisms, with dihedral summits. It is colourless; permanent in the air; has little alkaline taste; and scarcely browns turmeric paper. It dissolves in four times its weight of water at 60°, and is decomposed when it dissolves in boiling water. It consists of potassa 47.53, + carbonic acid 43.56, + water 8.91, = 100; or 1 prop. potassa = 47.15, + 2 prop. acid = 44, + 1 prop. water = 9, making the equivalent 99.15.

It is easy to demonstrate the difference of the quantity of carbonic acid in these two salts, by weighing a specific quantity of each, and saturating them with any acid so as to expel the carbonic acid which they contain.

Both of these salts, particularly the last, afford an agreeable mode of exhibiting Potassa as a Diuretic. The acid is partially separated in the stomach, and probably decomposed, while the alkali is carried forward to the kidneys, and acts there nearly in the same manner as pure potassa. The dose of the carbonate is from gr. x to ʒss, at first; but it may be augmented to ʒiii; that of the bicarbonate may be double the quantity of the carbonate. Both may be given in any bland liquid which does not contain lime or any substance

capable of forming an insoluble compound with carbonic acid. The diuretic properties of these salts is not injured by administering them in a state of effervescence with lemon juice; the citric acid being separated by the digestive powers of the stomach in the same manner as the carbonic; and, if any febrile heat be present, this is the best mode of exhibiting these carbonates.

3. ACETATE OF POTASSA. *Potassæ Acetas.* L. E. D.—This salt is formed by the direct combination of its constituents: and, since the introduction of the pyrolignous acid, which contains no vegetable matter, the salt has been obtained perfectly free from colour. On this account, the London Pharmacopœia now orders the employment of strong acetic acid instead of distilled vinegar, which always contains some mucus.

Acetate of Potassa is colourless and inodorous; it has a foliated texture, and a pungent saline taste; is extremely deliquescent; very soluble in water, and also in alcohol. For medicinal purposes, it is fused so as to produce a white crystalline, foliated mass, which is in general nearly anhydrous. Its constituents are 1 prop. potassa = 47.15, + 1 acetic acid = 51, making the equivalent 98.15; or 49 parts of potassa, + 51 of acetic acid in 100 parts. In the crystalline state, not fused, it consists of 1 prop. of acetate = 98.15, + 2 prop. of water = 18, making the equivalent 116.15.

When Acetate of Potassa is properly prepared, its solution should not be precipitated by nitrate of silver, the salts of baryta, nor by sulphuretted hydrogen. It is decomposed by the mineral acids; the sulphates of soda and of magnesia; and by the bitartrate of potassa, the tartaric acid of which forms a neutral tartrate with the potassa of the Acetate. In doses of ℈i to ʒi, this Acetate operates as a Diuretic; but in doses of ʒii to ʒiii, it exerts a cathartic influence.

As a Diuretic, Acetate of Potassa is undoubtedly decomposed in the stomach; and probably in this case the alkali only reaches the kidney. It has been given advantageously in hydropic diseases; but, frequently, it disappoints the practitioner: this sometimes, however, arises from its being overdosed; in which case it purges, and this necessarily coun-

teracts its Diuretic effect. It may be administered in the infusion of gentian, or any light bitter, or in any bland demulcent fluid. It is better to give it in small doses, frequently repeated, than in the full dose. I have seen it ordered, in cases of ascites, in conjunction with the bitartrate of potassa; but, for the reasons already stated, this combination purges and counteracts the intention with which both salts are ordered. Upon the whole, it is an unimportant Diuretic; and, as it is always administered in solution, it might have been left to extemporaneous prescription.

4. Citrate of Potassa. *Potassæ Citras.*—This salt is generally prepared by adding a scruple of the carbonate of potassa to fifteen grains of citric acid in solution, or half a fluid ounce of recent lemon juice. It is seldom prescribed as a Diuretic, but it is a useful vehicle for the administration of more powerful agents belonging to this order of medicines.

5. Bitartrate of Potassa. *Potassæ Bitartras.* L. E. D. —This salt has already been described (vol. ii, p. 324). In small doses, from gr. x to ℈i, it operates as a Diuretic. Its effects in this respect are explained by Dr. Paris on the probability of the decomposition of the salt in transitu; and consequently the conveyance of the alkaline base to the kidneys. It is possible that this explanation may be correct; but when we consider that the quantity of alkali contained in the dose of the Bitartrate is equal only to five grains, when a scruple of the Bitartrate is taken, and that seven grains of the alkali are taken when twenty minims of the liquor potassæ are administered, yet, that the effects of the Bitartrate are much more considerable in producing diuresis than the liquor potassæ, there is some difficulty in assenting to the accuracy of this explanation. The influence of the Bitartrate in dropsical effusions is well authenticated; and, indeed, every day's experience confirms confidence in its powers as a Diuretic. The emaciation which the continued use of the Bitartrate of Potassa produces when taken as a beverage, or in the form of imperial, as it is termed, demonstrates the powerful effect of this salt upon the absorbents; and it is through the kidneys, that the fluid, thrown by them into the circulating mass, is excreted. I have had frequent opportu-

nities of witnessing its beneficial effects in ascites, when this affection is not dependent on hepatic or other visceral obstructions. It is frequently and beneficially combined with squill, colchicum, and other diuretics; and, when given in a state of solution, with infusion of gentian and other bitter infusions. If the Bitartrate have weakened the digestive organs, which it occasionally does, it may be combined with tartarized iron. In cases which depend on hepatic or other glandular obstructions, its best adjunct is iodine, in the form of ointment; and in this form I have been able to continue the use of the iodine with much advantage, when the internal use of it would have been injurious. The Bitartrate, in these cases, was administered in the usual doses, as if the iodine were not employed. For diuretic purposes, the dose should never exceed ʒss: but it should be frequently repeated, until the kidneys be affected, diluting very freely during its employment.

The soluble Bitartrate formed by the addition of subborate of soda is said to operate also powerfully as a Diuretic. It requires only seven parts of water at 60° for its solution. It is not acted upon by boiling alcohol. The mineral acids decompose it very imperfectly; and tartaric acid produces no effect on it, even at a boiling temperature. I have had no experience of its powers; consequently, I cannot say any thing either in its praise or to its disparagement as a Diuretic.

6. CARBONATE OF SODA. *Sodæ Carbonas. Sodæ Subcarbonas.* L. E. D.—The remarks made on the Carbonates of Potassa apply to those of Soda. They are in fact Carbonates of the oxide of Sodium, which, like Potassa, is capable of combining with two proportions of carbonic acid.

The Carbonate is found ready formed in the Salsola Soda, a plant growing abundantly on the shores of the Mediterranean; in the ice plant, the Mesembryanthemum *crystallinum;* and in all the fuci, from which it is obtained by simply burning the plants and lixiviating the ashes. It is also found native in the soil in India, Thibet, and several tropical countries, and in the Natron lakes of Hungary and of Egypt. It is this salt which formed the nitron of the ancients. The best crude carbonate is barilla, which is procured from the Salsola

Soda and Salicornia *aerbacia:* kelp is an inferior variety, obtained by burning sea weeds on the coast of Scotland. The Carbonate, for medicinal use, is formed by boiling the *barilla* in water, filtering and evaporating to obtain crystals, which are Carbonate of Soda. The mother water retains the salts with which it is combined in the barilla.

The French chemists properly remark, that when barilla is employed to yield Carbonate of Soda, it is preferable to lixiviate with cold water, as the boiling water takes up many of the other salts contained in the barilla, particularly the sulphurets. Much of the Carbonate of Soda now used in this country is prepared from the decomposition of Sulphate of Soda and muriate of Soda, and a purer salt is obtained by this method than can be usually procured from the barilla*.

The Carbonate of Soda, when pure, is in large beautiful crystals, nearly transparent, with a rhombic base, the acute angles of which are generally truncated. The taste of this salt is acrid, urinous, and disagreeable: it is inodorous, and displays alkaline properties, deepening the solution of rhubarb, and browning turmeric paper. It is soluble in two parts of water at 60°, and in less than its own weight of boiling water; in which solution it crystallizes on cooling. It effloresces on exposure to the air. The chemical constituents of Carbonate of Soda are

Soda	20.92	1 prop.	=	31.3
Carbonic Acid...	14.38	1 —	=	22.0
Water	64.70	10 —	=	90.0
	100.00	Equivalent	=	143.3

This salt often contains Sulphate of Soda and common salt mixed with it. These adulterations are detected by forming the salt into a nitrate and adding nitrate of silver, which detects the common salt, and nitrate of baryta, which detects the Sulphate of Soda. The dose of this salt is from gr. xv to ʒii, in any vehicle not containing acidulous salts, lime water,

* To procure it from Sulphate of Soda, this salt, mixed with saw-dust and lime, is exposed to the heat of a reverberatory furnace. The sulphuric acid is decomposed and its sulphur partly united with the lime, partly dissipated in the form of sulphurous acid, while the carbonic acid generated in the process combines with the Soda. The Carbonate of Soda is then obtained by lixiviation and crystallization.

muriate of ammonia, nor solutions of earthy and metallic salts.

7. Bicarbonate of Soda. *Sodæ Bicarbonas*. L. E. D. —This salt, or rather a sesqui-carbonate, is found in a state of nature in the province of Stikena, in Africa, where it is called trona. The Bicarbonate is artificially prepared by passing through the solution of the carbonate a stream of carbonic acid gas. In its pure state it consists of

Soda	38	1 prop. =	31.3
Acid	39	2 — =	44.0
Water	23	1 — =	09.0
	100	Equivalent =	84.3

The crystals, if they can be regarded as such, are opaque, white, minute, and irregular: their water of crystallization has not been accurately ascertained.

The taste of this salt is scarcely alkaline; and, therefore, it can be taken with less disgust than the carbonate, and it is more generally employed as a Diuretic. Both these alkaline salts are given as Diuretics in dropsical affections, in which deposites of lithic or rosasic acids are found in the urine. As the crystallized salts are apt to effloresce and fall into powder, they are frequently dried before being administered, which enables them to be made up in pills. These salts, as well as the carbonates of potassa, are decomposed in the stomach, and the potassa and soda only are conveyed to the kidneys: they possess, therefore, no advantage over the pure alkalies, except in point of taste and greater mildness of operation. The tonic power of the carbonic acid, which is extricated in the stomach, prevents any unpleasant effect from the alkalies, even in the most irritable habits*. The dose of

* M. Robiquet (Journ. Pharm. 1826) states a case in which a large stone of uric acid was reduced by drinking daily a strong solution of Bicarbonate of Soda for three months. The remainder of the stone, reduced to the size of a pea, was passed by the urethra. The continued use of it has been thought to be injurious; but this is an erroneous opinion. M. D'Arcet remarks, that in the French manufactories of Carbonate of Soda, the workmen who are pounding, sifting, and barrelling the salt, respire and receive also into the stomach a large quantity of the salt which is constantly floating in the air, and that their clothes are always impregnated with it: yet these workmen enjoy good health, have no complaint but that of hunger, and are slightly constipated. He calculates that each workman swallows at least ten grammes of the salt per day.—*Ann. de Chimie. et Phys.* v. xxxi, p. 66.

the Bicarbonate is from gr. x to ʒi. It is decomposed by the same substances as the Carbonate.

8. Biborate of Soda. *Sodæ Biboras, Borax.* L. E. D.—(Vol. i, p. 487.) This salt is seldom employed as a Diuretic in this country. It, nevertheless, possesses diuretic powers, and may be given in doses of ʒss dissolved in almond emulsion or any bland fluid.

B. INDIRECT DIURETICS.

This division of Diuretics contains substances which act primarily on the nervous system, and secondarily on the capillary system, particularly the kidneys. These agents are of two distinct kinds: the one set diminishing arterial action, and throwing a large supply of fluids upon the circulating mass; the other set increasing the general tone of the habit, in which case the kidneys share in the benefit.

1.—DIMINISHING ARTERIAL ACTION.

* *Organic Products.*

n. Nicotina.—The influence of Tobacco in diminishing arterial action, whether taken into the stomach, applied to the surface, or injected into the rectum, would lead us to regard it as a remedy of great power as a Diuretic; and if it could be managed so as to controul the circulation, there is no doubt that, in the direct ratio of its influence in this respect, we should find it, by increasing diuresis, prove a most useful remedy in dropsical accumulations; but its unmanageable character has hitherto prevented it from being much employed as a Diuretic. No medicine requires so much caution in its administration under the most favourable circumstances; and, therefore, it has yielded place to other sedative Diuretics.

For diuretic purposes, any of the kinds of Tobacco may be employed, as they all contain Nicotina. This substance is supposed to be the active principle of Tobacco; but whether it excites the same stimulant action on the mucous membrane of the intestines as on that of the nostrils, it is difficult to demonstrate, although there is every reason to suppose that it does so; and probably, therefore, we may consider that Nico-

tina is the purgative principle of tobacco; but the sedative and antispasmodic properties of tobacco are undoubtedly due to its volatile oil; and it is the influence of this on the nervous system which produces the powerful sedative effect of tobacco when it is applied to an external surface. It nevertheless is contended that this volatile oil is not a direct sedative, but operates in the first instance as an excitant. Thus we are informed by M. Nick, of Tubingen, that smoking a pipe of Tobacco in the morning, even by those accustomed to its use, accelerates the pulse from fifteen to twenty beats in the minute, and this continues for an hour afterwards. Too little is known of the therapeutical qualities of Nicotina to allow us to say how it operates. It is not an alkaloid, but resembles the essential oils in its properties. In doses of a grain, it causes vertigo. Tobacco was introduced to the profession as a Diuretic by Dr. Fowler; and when administered in small doses, either in the form of infusion or that of wine, so as not to nauseate, it has been given successfully in dropsy; but, for the reasons which will always prevent Nicotina from being much employed, Tobacco has been less prescribed as a Diuretic than it deserves to be.

o. DIGITALIA. (Vol. i, p. 578.)—The diuretic powers of the leaves of Foxglove, Digitalis *purpurea*, are supposed to depend on this principle. Its efficacy, as a Diuretic, is modified by the period of the growth of the plant at which the leaves are collected, and the manner of drying and preserving them. They are in the best state in the months of July and August; at which time they should be gathered and dried between colourless bibulous paper, in a warm room, under moderate pressure. This trouble is necessary for the preparation of a medicine of so much activity, and which is administered in grain doses. When the dried pulverized leaves lose their green colour, some chemical change has taken place in them, which diminishes their activity; and, consequently, they should never be employed in this state.

As far as respects the diuretic powers of Foxglove, it should be recollected that its influence on the kidneys is not obtained in that condition of the habit which is regarded as the healthy standard of tone, nor in any state which exceeds

that limit; for no benefit can be expected from its employment as long as any tension of the vascular system exists. It is only after ample depletion, or at least such as reduces greatly the frequency of the pulse, that it affects the capillary system and augments the urinary discharge. It is after tapping and a reduction of arterial action, that decisive advantages are obtained from the employment of Foxglove in hydropic affections.

In looking into the history of Foxglove, we find it in the Pharmacopœia of the London College, in the beginning of the eighteenth century, although it was omitted in 1746, and was not reinstated until 1788, ten years after its practical restitution as a Diuretic by Dr. Withering, who brought it before the profession in 1775. In consonance with the condition of habit which I have mentioned, as favouring the diuretic influence of Foxglove, Dr. Withering and those who have followed him, have found it most useful in lax, pale, leucophlegmatic habits; and if the disease be anasarca, in those cases in which pitting is left on pressure of the affected parts: thence, when this state does not exist, the system must be lowered by blood-letting and purging, before any advantage can be expected from Foxglove as a Diuretic. It has been found most beneficial in hydrothorax, and, next to that, in anasarca. In cases of dropsy, also, following scarlatina, it has been found very useful, after purgatives have been freely employed, and in those instances of anasarca, and occasionally of ascites, which attack constitutions broken down by long and severe courses of mercury. The best adjuncts to Foxglove, in these cases, are bitartrate of potassa, acetate of ammonia, and colchicum; and, in broken-down constitutions, it is beneficially conjoined with nitric acid.

It may be given either in the form of infusion or tincture, or in the state of powder of the dried leaves. If administered in the form of powder, it is frequently combined with calomel and squill; but these adjuncts are supposed not to be very admissible. Dr. Blackhall remarks, "the practice is unsafe and not very consistent." He regards the depressing effect of digitalis to be at variance with the stimulant effect of the calomel; and adds, speaking from expe-

rience, "where the urine is coagulable, and digitalis agrees, both calomel and squill are positively injurious. On the contrary, where the urine is foul and not coagulable, and squill with calomel render service, I have on that very account made less trial of digitalis, and cannot therefore speak of it from experience." My experience does not accord with Dr. Blackhall's views; and I believe that Foxglove acts as an excitant on the capillary system.

The dose of the powder should be gr. i, frequently repeated: but, when its effects display themselves, it should not be repeated oftener than once in twelve hours; then, once only in twenty-four hours; and, ultimately, in forty-eight hours, to prevent its accumulation in the system. The form of infusion obtained by pouring f℥vii of boiling water and one of cinnamon water over ʒi of the dried leaves, and macerating for four hours, speedily produces the diuretic effects of the plant: but much of the efficacy of both these forms depends on the manner in which the leaves have been preserved. The tincture is a very excellent form, as it can always be made when the leaves are in the best condition. The dose of the infusion is f℥i to f℥iss, repeated once in five hours; the dose of the powder, gr. i to gr. ii, repeated once in six hours; and that of the tincture, m. x at first, once in four hours; but this dose, in many cases, may be gradually augmented to m. lx, and even to lxx, three times a day.

When an overdose of Foxglove is taken—for I know of no instance in which it has been taken as a poison, with the view of committing murder or suicide—the symptoms are nausea, vomiting, vertigo, pulsation in the temples, a sense of heat throughout the body, occasionally diarrhœa, sometimes, but rarely, salivation, and, for the most part, profuse sweating. In a few instances the result has been fatal. One symptom recorded in some of the cases is remarkable—a suppression of urine. Post-mortem examinations of the body have displayed the brain much injected with blood, and the villous coat of the stomach displaying redness in some parts. When poisoning by Foxglove has taken place, the best remedial agents are ammonia, brandy and water, and opium: and the stimulus of a blister to the region of the stomach, which

rouses the nervous energy and gradually restores the functions of the sensorium.

One circumstance connected with poisoning by Foxglove should be more generally known than it is—I refer to the singular fact of the medicine accumulating in the habit like mercury, and bursting forth with violence when not expected. No medicine, therefore, requires to be more closely watched in its effects, whether it be given in moderate doses, long-continued, to produce diuresis, or it be administered, in gradually augmented doses, to lull delirium and procure sleep in mania. At all times, when nausea comes on, the dose should be diminished; and we must recollect that vomiting instantly arrests the diuretic influence of Foxglove.

p. LACTUCARIUM (vol. i, p. 591).—This is the inspissated juice of the Lactuca *sativa* and L. *virosa**, plants belonging to the natural order Compositæ.

These plants contain a white, opaque, proper juice, contained in the vessels chiefly under the cuticle. It is most abundant when the plant is in flower; indeed, so much so at that time, that it exudes from the vessels in drops when the stems of the panicle are touched; the juice therefore, should be gathered at this time.

The odour of these plants is narcotic, resembling that of opium; and the taste, which depends on the milky, proper juice, is bitter and slightly acrid. This inspissated juice of the garden lettuce was introduced into practice as a narcotic by the late Dr. Duncan. He imposed upon it the name of *Lactucarium.* It may be collected in various ways; the best method is to make transverse incisions in the shoots of the plants when they are in flower, and to scrape off the exuded juice. The relative quantity yielded by one plant of the garden lettuce and one of the Lactuca *virosa*, is in the proportion of seventeen grains of dry Lactucarium from the garden lettuce and fifty-six from the Lactuca *virosa.* Besides this method for procuring the juice, the following is also used:—the plant is to be broken into small lengths, without employing a knife, except in the tougher parts of the stem, which contain little proper

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* Woodville's Med. Bot 3rd edition, p. 75, pl. 31. London Dispensatory, art. Lactuca.

juice, and then the whole is to be submitted to the press, and the expressed juice inspissated with a moderate degree of heat. It is this preparation which is used as a Diuretic, in doses of from five grains to ʒi or more, gradually augmented. It has been found useful in some cases of hydrothorax by the German physicians; but, in this country, we place more confidence on Foxglove; and, therefore, the inspissated juice of the Lactuca is rarely prescribed. Orfila has placed the L. *virosa* among the acro-narcotic poisons: but its poisonous properties, if they exist at all, are feeble.

From the similarity of the taste and odour of the proper juice of the strong-scented lettuce to those of opium, the active principle has been supposed to be morphia; but if this alkaloid be present, the quantity of mucus is so great that it cannot be separated. If we try the effects of the sulphate of iron on the solution of opium and on that of Lactucarium, we shall soon be convinced that their components are different. That there is, at least, no meconic acid present in Lactucarium.

* *Inorganic Substances.*

q. TINCTURE OF MURIATED IRON. *Tinctura Ferri Muriatis.* L. E. D.—This is an etherial solution of the Muriate of Iron. Its effects upon the bladder arise from nausea, probably that which follows its exhibition in the manner prescribed by M. Cline, relaxing the spasm of the sphincter muscle of the bladder, which causes the retention of urine, for which it is prescribed. It is not, assuredly, a Diuretic, in the strict meaning of the term, as it does not operate on the urinary secretion, but merely affects the bladder of urine. For this purpose, it must not be administered in any solution containing gum acacia, as this decomposes it. It may be administered in doses of m. x every five minutes, until the desired effect is produced.

Some excitants are also beneficially employed as Diuretics when no inflammatory symptoms exist to contraindicate their employment. They are chiefly combinations of alcohol and volatile oil; such, for example, as are found in gin and whiskey. The following combination of nitric ether and alcohol is still more commonly used:

r. SPIRIT OF NITRIC ETHER. *Sweet Spirit of Nitre.*

Spiritus Etheris Nitrici. L. E. D.—This compound is formed by mixing together three ounces of nitre and two pints of alcohol, making the mixture so gradually that the heat shall not exceed 120°. Faht. and then distilling off twenty-four ounces. A portion of each of these ingredients is decomposed, and Nitric Ether formed by the recombination of their elements in the following proportions :—4 prop. Carbon = 24, + 5 Hydrogen = 5, + 1 Nitrogen = 14, + 4 Oxygen = 32, making the equivalent 75. The Nitric Ether rises with the alcohol and is condensed with it, forming the Spirit of Nitric Ether.

This spirit is colourless, has a fragrant, etherial odour, and a pungent, slightly acid taste. Its specific gravity is 0.834 ; but it is less inflammable and volatile than sulphuric ether. When recently made and mixed with tincture of guaiacum, it strikes a deep-blue colour, owing to some uncombined nitrous acid contained in it. When it has been kept long enough to assimilate this acid, no such effect is produced. It is incompatible with solution of sulphate of iron. The dose of this spirit is from ten to forty minims, in any bland vehicle ; and in this form it is a very generally employed Diuretic.

Besides the Diuretics which are of a material nature, the urinary secretion is powerfully influenced by the passions of the mind. Fear is one of the passions which operate powerfully on the urinary organs : the secreting and excreting vessels lose their contractile force, and thence a great flow of urine is a consequence of Fear. Sweat drops appear on the forehead, and a diabetes or a diarrhœa often follows. The urine voided under such circumstances is pale ; the desire of passing it frequent ; and the sphincter of the bladder is affected. But the physician cannot take advantage of this mental affection in the treatment of disease.

2. DIRECT DIURETICS WHICH OPERATE BY AUGMENTING THE TONE OF THE HABIT.

The Diuretics under this division consist of tonics and excitants ; they operate by producing a secondary effect on the kidneys.

The influence of tonic substances, as Indirect Diuretics, is most felt in those diseases in which the powers of the system are greatly diminished, and there is a consequent accumulation of fluid in the serous cavities and the cellular tissue; as, for example, in asthenic ascites which sometimes follows acute diseases: but, in these cases, although the bitter vegetable tonics will do much, yet even the tone which they produce is hurtful, unless the secreting organs be stimulated to more healthy action; purgatives, therefore, ought to precede their use, and mercurials be employed at the same time. In such cases, also, much benefit is derived from the ferrum tartarizatum, which, besides operating as a tonic, exerts a direct diuretic influence, and has been found peculiarly serviceable in anasarca connected with affections of the heart; but, in these cases, its employment should be preceded by purgatives.

3. INDIRECT SUBSTANCES WHICH OPERATE PRIMARILY ON THE CAPILLARIES.

These are chiefly Mercurials. Much benefit is derived from their aid in promoting the operation of other Diuretics; for they are seldom used alone as Diuretics. Thus, the diuretic influence of Squill and Colchicum is rendered more certain by being combined with Calomel, and that of Digitalis when combined with the blue pill. "The efficacy of this," says Dr. Murray, "is probably derived from the mercury stimulating the absorbents, and by introducing the effused fluid into the system, promoting the direct diuretic action of the vegetable diuretic." The mercury stimulates the capillary system, and in this manner aids the active principles of other Diuretics on the kidneys.

THERAPEUTICAL EMPLOYMENT OF DIURETICS.

After the view which has been taken of the substances most commonly employed as Diuretics, their practical utility as remedial agents may be briefly stated. Their character of operating as stimulants on the kidneys points out the propriety of not employing them in cases of inflammation of the kidneys. With regard to their influence in febrile

affections, much must be done before prescribing them; but, in long-protracted fever, whether intermittent or continued, if œdematous swellings occur, their use is indicated, and must not be delayed. If they be prescribed during fever, it must be recollected that one of the most distressing symptoms in that disease is retention of urine; and therefore, in prescribing Diuretics, it is highly requisite to examine daily the state of the bladder. Most fevers in their termination display critical changes either in the quantity or the quality of the urinary discharges; and therefore, under such circumstances, it becomes a question how far a Diurectic is likely to favour such a crisis. At the commencement of fevers, the urine is generally pale; it becomes afterwards high-coloured; and, at the termination of a paroxysm, if the fever be intermittent or remittent, or when it begins to decline, if it be of a continued type, a sediment, either of a brick-red colour, lateritious as it is termed, or of a pale pink colour, is deposited, and has been regarded as critical: but this sediment is to be viewed rather as the result of a certain catenation of actions than as the excretion of any thing injurious to the habit; and, were Diuretics able to promote it, they would be of no avail. Upon the whole, therefore, even as simple evacuants, Diuretics are of little value either in idiopathic fever or in acute diseases where fever is a symptom. They have been advantageously administered in some chronic diseases, especially those accompanied with eruptions on the skin; but the chronic affections in which their influence is most beneficial are dropsies. This class of diseases consists in such an atony of the capillary system, that, instead of the capillaries carrying forwards the fluids which they contain, they pour them out into the serous cavities and the cellular membrane*, whilst the balance between exhalation

* In anasarca it is generally stated that the fluid is deposited in the cellular membrane; but Dr. William Hunter contended that it is not in the same cells of this membrane as those which contain fat. The chief arguments he urged were—that those parts, such as the eye-lids, the penis and scrotum, in which the fluid in anasarca is most deposited, contain no fat. Dropsical parts pit on pressure: the fluid disperses and returns, which is not the case with parts distended by fat; although the same thing takes place when oil is poured into the common cellular membrane after death.—*Med. Obs. and Inquiries*, vol. ii, p. 33.

and absorption is broken, and the effused matter overpowers the absorbents. Diuretics are prescribed to cure dropsies in every form ; and they do so by stimulating the capillaries, so that, no fresh effusion taking place, the absorbents are enabled to take up the already effused fluid, and to throw it upon the kidneys, its natural emunctory. When success attends the administration of Diuretics in dropsy, one advantage which results from their employment over drastic purgatives and some other remedies is the little debility which they occasion. If Diuretics, however, be given alone, they are uncertain in their effects, and seldom, in that case, do they deserve more than the title of palliatives; but, as adjuncts to other means, they aid materially the evacuation of the effused fluid, and they have thus frequently effected the removal of general dropsy. Their success, however, is very precarious; and so many circumstances interfere with their operation, that it is difficult to form a prognosis of their expected effects. Sometimes they operate freely, increasing greatly the discharge of urine, and yet the dropsical swellings continue. In this case, some organic mischief must be looked for; and, unless this can be discovered, no great advantage can be expected from the evacuation of the effused fluid. The kinds of dropsy in which *direct* Diuretics have proved most successful are anasarca and ascites ; whilst those which operate by diminishing arterial action and augmenting that of the capillaries are the best adapted for hydrothorax. But even in any case, the influence of Diuretics hinges upon so many accidents, that all of them are precarious in their effects. In encysted dropsies, they are utterly useless, unless preceded by reducing the sac to the state of an extraneous body.

Diuretics have been prescribed in calculous diseases ; and most of the substances called lithontriptic are Diuretics. We have ample proofs that none of them act chemically in dissolving calculi ; nor indeed can they be said to effect any change on the kidneys sufficient to prevent the formation of calculous matter. It is probable that the benefit accruing from their employment is wholly due to their influence on the stomach and digestive organs ; and, by their aiding in the

formation of a better gastric juice, the digestive process being rendered more complete, all the secretions as well as the excretions must necessarily become more healthy, and cease to deposite the uric and other acids in the pelvis of the kidneys.

In conclusion, we would say that the efficacy of this order of remedies depends greatly on the state of the nervous system*; and more on the tact of the prescriber, and his intimate acquaintance with the changes, both structural and functional, which disease produces on the system, than on any other. The operation of no other order of medicines is so much modified by circumstances; and no other medicines require so much attention as these for ensuring their beneficial effects. The following rules ought always to be strictly observed during the administration of Diuretics.

1. The surface of the body must be kept cool.

2. They should be administered during the day, and whilst the patient is out of bed.

3. The use of diluents is essential, and ought to be urged more especially when the saline Diuretics are employed.

4. Little advantage can be anticipated from the use of Diuretics in those dropsies which originate in organic affections of the liver or the chylopoetic viscera: it is only in those cases connected with debility, and deranged action of the caipllary system, that Diuretics can be regarded as certain remedial agents.

5. When the fluid is removed, the administration of tonics is necessary to prevent relapse.

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* M. Krimer divided the nerves of the par vagum in a dog, emptied the bladder, and injected a solution of rhubarb into the stomach, but no trace of it could be found. He connected the divided ends of the nerves by a voltaic pile: in a short time the rhubarb could be traced in the urine; he again interrupted the current, and it wholly disappeared from the secretion.—*Physiologische Untersuchungan, Leipsic,* 1820.——Wilson Phillips had previously ascertained nearly the same thing.

SECTION XVI.

EMMENAGOGUES*.—MEDICAMENTA EMMENAGOGA.

THESE are medicines which promote the menstrual discharge. It has been doubted whether any medicines act directly upon the uterus; the apparent agency of some in promoting its periodical discharge being referred to their influence in producing a condition of the system favourable to health, and the uterus sharing in the salutary effect. To determine the correctness of this opinion, we must first take into consideration the nature of the uterus in the unimpregnated state; the character and causes of its periodical discharge; and, lastly, whether the organ can be directly acted upon by any medicines taken into the stomach, or any applications to the surface of the body.

The texture of the uterus is muscular, but the fibres are denser, firmer, and more compact than those of the other muscular textures of the body; and it abounds with blood-vessels; the arteries are tortuous, and the veins destitute of valves; it is also well supplied with nerves, and with lymphatics on its external surface. The existence of nerves in the substance of the uterus was long doubted; but modern discovery has put both this question and that of its muscularity at rest. Internally, the uterus is lined with a soft, delicate, spongy membrane, composed chiefly of capillary vessels. That part of the cavity, however, which forms the canal of the cervix, exhibits a very different surface; it is firmer, callous, and less vascular, with oblique and transverse rugæ, which exude a mucous fluid. Such is the organ—what is its function in the unimpregnated state? How far is it adapted to perform the functions of a secreting organ? Is the periodical discharge a true secretion, or a mere discharge from vessels oppressed by a local plethora?

In reply to the first of these queries, it is scarcely necessary to say that its function is menstruation—a discharge recurring once a month; commencing at the period of puberty, and ter-

* Derived from ἐμμηνια, the menses, and ἀγω, I induce.

minating between the fortieth and fiftieth years of age. The second and third queries involve matters of controversy; but the prevailing opinion is in favour of the capacity of the uterus to secrete, and, consequently, that the discharge which it exudes is a real secretion*.

There is nothing in the anatomical structure of the uterus that unfits it for the function of secretion; and were any arguments necessary to refute the notion that menstruation depends on a general plethoric orgasm, it would be only necessary to mention the facts, bearing on this point, presented by the Hungarian sisters. These two females were united at the lower part of the back, and lived to the age of twenty-two. The same blood flowed in the vessels of each; for the abdominal vessels were found, after death, united at the loins; yet the uterine function was distinct in both; it differed in its period, and also in the quantity of the discharge. Were the menstrual discharge a mere flow of blood from dilated or ruptured vessels, this state would have been long since ascertained in the examination of the various cases which have terminated in death during menstruation; but the closest microscopic investigations have displayed no appearances which give support to such a belief. Others, arguing from the analogy of hæmorrhoids, and the swelling of the uterine veins at the moment of menstruation, have contended that the discharge proceeds from the uterine veins: but this opinion has had very few supporters.

Indeed, in reflecting on the nature of the organ itself, on its resemblance to other glandular organs in the manner in which it is supplied with blood, and on the adaptation of its internal surface to exhalation, we can have little hesitation in admitting, that the manner in which the periodical discharge is supplied closely resembles that of a secreted fluid†. The uterine vessels are not only exceedingly convoluted, but they

* This discharge is peculiar to females of the human race, although Cuvier has stated, that he has observed indications of it in females among quadrupeds: and it is undoubted that something like it exists in the monkey tribe.

† M. Lecanu ascertained that the blood drawn from the arm of a woman during the flow of the menstrual discharge contains little more than one half the quantity of globules, which the blood of the same individual displays at other times.

are larger, and have thinner coats than the veins, in the unimpregnated state: the blood is therefore brought into the organ readily, and in considerable quantity, whilst it is slowly returned from it—a condition of vessels highly favourable to the secreting function. It is true that, previous to menstruation taking place, there are symptoms indicative of general plethora as well as of local congestion; yet this fact only proves that the discharge is connected with such a state of the system; not that it is caused by this state, nor that the relief which follows is attributable to blood being discharged by the uterine vessels. The admission, also, that there is an increased determination of blood to the organ at the period of menstruation, does not militate against the idea that the discharge is a secretion, since it is very well known that every glandular organ, when excited by its appropriate stimulus, becomes a centre, as it were, to which the blood is directed; and this is strikingly observable in those which are only periodically called into action. Again, if this discharge were merely the effect of a local plethora, it would be blood, which is not the fact; for it does not coagulate like blood, nor does it contain fibrine; but "has the properties," as Mr. Brande has remarked, "of a very concentrated solution of the blood in a diluted serum." If it be thus evident, from reasoning, and from the chemical nature of the discharge, that menstruation is not the mechanical result of a local congestion, let us examine how far observation supports the opinion that it is a *secretion*.

We know that glands are excited to the exercise of their secreting function by some specific impression, either mental or corporeal: the salivary glands are excited by the thought of savory food; the testicle is excited to the elaboration and excretion of semen by the desire of sexual intercourse; and it is probable that the action of the uterus is influenced by some state of the ovaries; for when these organs are either absent or are much diseased, no menstruation occurs. It is not easy to explain its periodical returns: the intervals being exactly those of the course of the moon in the revolution of her orbit, they were supposed to be influenced by this planet; but were this the case, the menses ought to correspond with

one of the phases of the moon's course, which is not the fact. *Van Helmont* thought to explain it on the then prevailing doctrine of fermentation; *Stahl* referred it to the vis medicatrix labouring to relieve the female constitution of a superfluous accumulation which occurs monthly; whilst *Gall* endeavoured to prove that some external cause, which he could not discover, but not the moon, influences the period, as he ascertained it to be a general law, that all women menstruate at the same epoch. Without admitting any of those opinions, all of them being as untenable as the hypothetical idea of lunar influence—an opinion not rendered more acceptable by its antiquity—the truth or error of the theory that menstruation is a secretion does not depend on the necessity of an explanation of its periodical return.

The uterus, as has been already stated, resembles a gland in its vascular structure; and this resemblance extends to its diseases—an inflammatory state excited in it being often followed by scirrhus and cancer. Like other secreting organs, also, its function is often imperfectly performed, and the secretion, therefore, is liable to vitiation and derangement. In the first efforts of the organ, the secretion is usually thin, colourless, and deficient, and its recurrence is irregular and protracted; when it is suppressed, it cannot be restored by inducing plethora; nor can the flow, when it has commenced, be checked by venæsection, nor by any other means of depletion. In making this remark, I must not be misunderstood: it is not my intention to assert, that inordinate evacuations in other parts of the system do not influence the uterine discharge; on the contrary, I am perfectly aware that preternatural evacuations induced in the other organic systems will suspend the course of the catamenia, on the same principle that increased action of the intestinal system suspends the action of the cutaneous exhalants; and, *vice versa*, sweating checks diarrhœa. Any argument, founded on the supposition that the structure of the uterus is not sufficiently glandular for a secreting organ, falls to the ground, when we reflect that the gastric juice is secreted by the stomach, which is more simple and less like a glandular organ than the uterus. I shall only add, that the correctness of the opinion

that the catamenia are a secretion does not depend altogether on circumstances connected with the state of the organ itself; experience having ascertained that this discharge is intimately connected with the state of the ovaries. It is not necessary for the establishment of the truth of this opinion that we should be able to explain the cause of the periodical return of the discharge. If menstruation depend, as I maintain it does, on the secreting function of the uterus, it is obvious that, in the unimpregnated state, it ought always to happen at its regular period, when the organ is in a natural or healthy state; and that, in order to promote its return, when it is interrupted or suspended, such medicines must be employed as will restore the organ to that precise state or condition on which the exercise of that function depends.

It may be doubted whether there are any medicines which, taken into the stomach, will excite the flow of the menses by stimulating immediately the nerves and vessels of the uterus, in the same manner as the kidney is stimulated by medicines which are carried into the system and pass directly to that organ. But it cannot be denied that some medicines appear to act more directly upon the uterine system than others; and it is to these only that the appellation Emmenagogues can be properly applied. They may be such as will act either immediately on the uterus itself, or such as will merely influence that organ as a part of the general system. Emmenagogues, therefore, may be arranged under two heads—*direct* and *indirect*. We can understand the manner in which both operate, and the propriety of employing the one or the other, if we have a clear idea of the nature of the morbid condition of the organ, and whether the obstruction or interruption of the periodical discharge depend on a diseased state of the uterus itself, or is the effect of the presence of other diseases in the system.

In some instances, suppression of the menstruation is a primary affection; "often," as Dr. Denman has justly remarked, "though not universally, succeeded by a certain train of untoward symptoms:" but more frequently it is the result of other diseases; and, therefore, the nature of these,

as well as the state of the patient, with respect to vigour and constitution of body, must determine the kind of remedial agents to be selected as Emmenagogues. Thus, when the delay of the regular appearance of the discharge, after it has once appeared, occurs in females with a pale or leucophlegmatic countenance, indicating an atony of the vital powers, stimulant and tonic means are required, to give to the vascular system that degree of power which is requisite to maintain the healthy action of the capillaries ; on the contrary, when the complexion is florid, when there is much tension of the system, or when the suppression is connected with great irritation of the uterine system, it is easy to understand that menstruation is more likely to be aided by whatever diminishes excitement and sooths and calms irritation than by stimulants. Thence the fact, that very different, nay, very opposite, remedies are required to remove amenorrhœa in different instances.

Stimulants, whether corporeal or mental, undoubtedly tend to an early development of the uterine organs, and, consequently, to the appearance of menstruation sooner than is usual: thus, in tropical climates, and in those females who indulge in luxurious and pampered habits, the age of puberty is earlier than in those who inhabit the temperate and frigid zones, and those whose habits and passions are better regulated. The continued influence of stimulants is said, also, to prolong menstruation beyond the period of life at which it usually ceases ; but this is at least problematical. All Emmenagogues are more or less stimulants ; and, in cases in which a stimulant influence is contraindicated, they cannot be employed until the excitement be reduced, and then only under certain restrictions.

When the uterine obstruction is accompanied with a *pale* complexion and a languid state of the system, a variety of medicines are prescribed, either with the view of directly influencing the *uterus*, and promoting the menstrual discharge by some specific action, or by invigorating the habit, and thence eventually promoting its secretory function. Medicines of this kind, however, do not always bring on the menstrual discharge, although they improve greatly the general

health. By their indiscreet employment, also, much injury may be done to the organ itself. It ought, besides, to be well understood, that idiosyncracy, natural conformation, diseased states of the uterus itself, or of the ovaries, are often opposed to the salutary influence of Emmenagogues.

It may be doubted, as I have already mentioned, whether there is any medicinal agent which, when taken into the stomach, exerts a directly stimulant influence on the uterus; but, if we admit that some substances find their way to particular organs—for instance, nitre to the kidneys—there is no reason why such should not be the case with regard to the uterus: experience, however, has not yet demonstrated that this is the case; but a stimulant effect may be propagated from neighbouring parts to the uterine vessels: thence some cathartics, which operate chiefly upon the rectum, are found to influence the uterus.

When the obstruction is accompanied with a *florid* complexion, and the colour of the cheeks is the flush of disease, not the glow of health*, or when a slight cough with pain in the chest and difficulty of breathing accompany the suppression, bleeding, and other antiphlogistic means of treatment must be resorted to before taking into consideration the uterine function; and, until the general excitement be subdued, the employment of Emmenagogues would be injurious. It is questionable whether, in these cases, any of those substances supposed to act directly upon the uterus should be employed? If they can be administered, they will be most likely to prove beneficial when given immediately after the reduction of febrile excitement.

The employment of Emmenagogues is not confined to cases of simple obstruction or suppression. In some females, the pain with which menstruation is accomplished embitters much of life. This either indicates a peculiar state of the organ, or it is the effect of disease, or at least the tendency to it, in the organ itself; not, as is sometimes supposed, an increased degree of the irritability of the general system. Some of the substances employed as Emmenagogues are supposed directly to lessen uterine irritation, and consequently

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* Denman.

to facilitate the discharge; thence they are thus closely allied with sedatives and antispasmodics.

In the following table of Emmenagogues, I have arranged them under two distinct heads; the *first* containing those substances which are supposed to operate, by their stimulant influence, on the uterus itself: the *second* those which influence the uterus sympathetically by their action on other organs: or into *Direct* and *Indirect* Emmenagogues.

The first of these divisions I have subdivided into *Immediate* and *Mediate*. In the second of these subdivisions, some substances will be found the direct influence of which on the uterus is doubtful: they maintain their place rather in conformity with the prevailing opinions than from a conviction that their action on the uterine system is such as to authorize the position which they hold.

TABLE OF EMMENAGOGUES.

A. DIRECT EMMENAGOGUES.

1.—Immediate.

a.—ELECTRICITY. *Electricitas.*

2.—Mediate.

* *Organic Products.*

b.—OLEO-RESINS—contained in

Roots—	Polygala *Senega.*	17.	3.	Polygaleæ.
	Ruta *graveoleus.*	10.	1.	Rutaceæ.
Herb—	Juniperus *Sabina.*	22.	8.	Coniferæ.

c.—BITTER PRINCIPLE—contained in

Roots—	Rubia *tinctorum.*	4.	1.	Rubiaceæ.

* * *Inorganic Substances.*

d.—MERCURIALS. *Preparationes Hydrargyri.*

B. INDIRECT EMMENAGOGUES.

1.—operating on the kidneys and intestinal canal.

a.—NITRATE OF POTASSA.

b.—BITTER PRINCIPLE—in

Proper Juice—Aloë *Spicata.*	6.	1.	Liliaceæ.
—— *vulgaris.*	–.	–.	———.

c.—GUM-RESIN—contained in

Roots—Helleborus *niger.*	13.	7.	Ranunculaceæ.
Proper Juice—Camboge.			

2.—operating on the stomach.

* *Organic Products.*

d.—VOLATILE OIL—contained in

Roots—Valeriana *Officinalis.*	3.	1.	Valerianeæ.
Aristolochia *Serpentaria.*	20.	1.	Aristolochiaceæ.
Herb—Artemisia *Abrotanum.*	19.	2.	Compositæ.

* * *Inorganic Substances.*

d.—OXIDES AND SALTS OF IRON. *Oxydi ei Ferri Sales.*

Natural.

Carbonate of Iron.
Sulphate of Iron.

Artificial.

Black Oxide of Iron.
Alkaline Solution of Iron.
Ammoniated Iron.
Sulphate of Iron.
Tartrate of Iron.
Carbonate of Iron.

3.—operating on the nervous system.

* *Animal Products.*

e.—CASTOR—formed by the

Castor *Fiber.*	1.	4.	Rodentia.

* * *Vegetable Products.*

f.—OLEO-GUM-RESINS – contained in

Ferula *Assafœtida.*	5.	2.	Umbelliferæ.
Galbanum *Officinale.*	5.	2.	———

g.—DIGITALIA—contained in
Digitalis *purpurea.* 15. 1. Scrophularineæ.

h.—UNKNOWN PRINCIPLE—contained in
Secale Cornutum.

A. DIRECT EMMENAGOGUES:

1.—OPERATING CHIEFLY ON THE NERVOUS SYSTEM.

1. IMMEDIATE.

a. ELECTRICITY. *Electricitas.*

The nature of this powerful agent has been already investigated. It is transmitted readily through animal bodies, and it can be accumulated in them. In receiving or parting with Electricity, a painful sensation is felt at the place of communication ; and this is extended when a shock, or a portion of the electrical fluid, passes through the body, as forming part of a chain of conducting substances. Thus, if a discharging rod attached to a chain communicating with the outside of a charged Leyden jar be applied to the one side of the pelvis, and the knob communicating with the inside of the jar be applied to the opposite side, a feeling is instantly produced as if a small sword was thrust through the part; and a stimulant impulse is given to the uterus by the direct passage of the electrical fluid through it. The stimulant impulse of a shock thus communicated is obvious by the sensation which it excites ; but it equally takes place, although in a less degree, when no sensation is produced as when a continued current of the fluid is passed through the organ, by making it a part of a circuit communicating with the prime conductor of an electrical machine, or in making it part of the circuit of a Galvanic trough. The direct application of electricity is admissible only when a torpor of the uterus exists, indicated by a suppression of the catamenia, with a pale complexion, and a languid state of the circulation. But, even in this

state of the habit and the organ, it should be remembered that, whilst applied in moderation, this agent rouses the activity of the torpid uterus; in large quantity, it injures materially, if it do not altogether destroy the excitability of the organ. When the complexion is florid, a treatment the reverse of stimulant is required, particularly if febrile symptoms, with some oppression of respiration, be present: bleeding, purging, and antiphlogistic measures, instead of electricity, are then required. In employing electricity, therefore, as an Emmenagogue, it should be first used under the form of accumulated electricity, or the bath, as it is termed, then sparks, next the aura, and, lastly, shocks should be given. At first the shock should be moderate; as, in nervous habits, syncope has followed the incautious communication of powerful shocks; but with ordinary caution in its application, Electricity has been found a powerful agent in amenorrhœa depending either on general debility of the system or on atony of the organ itself.

Proposals have been made for employing it in menorrhagia arising from debility of the uterine vessels; but I am unable to say, on my own experience, how far this is a judicious measure.

2. MEDIATE.

* *Organic Substances.*

b. ROOT OF DYERS' MADDER. *Rubiæ Tinctorum Radix.* L. E. D.—Rubia Tinctorum is a native of the south of Europe; but it has been long cultivated in Zealand for the use of dyers. It belongs to the natural order Stellatæ. The root, which is the part employed, both in medicine and in the arts, consists of long, succulent, articulated fibres, about the thickness of a large quill, united in a caudex, from which many lateral side-roots proceed, extending under the surface of the ground, and sending up the shoots or herbaceous parts.

The dried roots of Madder are somewhat translucent, reddish, and have a strong smell. The roots, when perfectly dried, are pulverized so as to produce three descriptions of powder. The first and second consist chiefly of the

fibrillæ and skins of the larger roots; the second is a little bitter only; it is the third which is called *Crop Madder*, and is imported for medicinal use. Besides the qualities which I have just noticed, Madder has a bitter, slightly harsh taste. It attracts powerfully the moisture of the atmosphere, and is injured when it becomes damp. Madder imparts a pink hue to water at 60°; but when the fluid is boiled, a deep brown tint is produced. Its chief constituent is Extractive—a fact which is rendered evident by the effect of muriate of tin, which is decomposed, and throws down an oxide of tin combined with the Extractive. It is also precipitated by subacetate of lead, alum, the alkaline carbonates, and lime water. The colouring principle of the plant has been ascertained by Robiquet and Collin to be a peculiar acid, which they have named *Alizarine.* It is procured by digesting the Madder in four parts of sulphuric ether, evaporating to the consistence of a syrup, and then drying it spontaneously. It is then reduced to powder, and sublimed into a cone of paper. The acid sublimes in yellowish red, brilliant, diaphanous, acicular crystals. Carbonate of magnesia imparts to the infusion a bright blood-red colour; and, when evaporated, leaves a residue very readily soluble in water, which is an alizarinate of magnesia. When agitated with chlorine gas, the extractive is oxidized.

As an Emmenagogue, Madder has been long employed and relied upon, without any certainty as to the manner in which it acts; although, from its tinging the urine, as well as the bones, of a red colour, it has been supposed that, as it passes into the circulation, it finds its way to the uterus, and directly influences that organ. The late Dr. Barton, an American physician of considerable eminence, placed great reliance on its deobstruent powers; and it was also much esteemed by the late Dr. Home, of Edinburgh, who, in his "Clinical Experiments and Histories," has recorded his decided opinion of its efficacy as an Emmenagogue. He gave it in doses of from ʒss to ʒi, twice or three times a day. Any power which it possesses as a deobstruent in amenorrhœa must, however, be referred to its bitter extractive; but as the idea of its direct action on the uterus may have originated

from the observation, that its colouring matter enters the circulation, Madder may be considered an equivocal Emmenagogue. It is now rarely employed.

e. OLEO-RESINS.

The volatile oil in the following substances is their active principle; but, when this is not separated by distillation, it is combined with resin, and, therefore, I have employed the term Oleo-resins.

* *Roots.*

1. SENEGA ROOT. Polygalæ *Senegæ Radix.* L. E. D.—Senega Root has a bitter, pungent taste, and is nearly inodorous. The active principle resides in the bark, the central part being nearly inert; and, when chewed, the pungency of this principle produces a hot, tingling sensation in the fauces. Besides the components discovered by Peschier (vol. i, p. 416), it contains also a considerable proportion of resin and volatile oil.

As a medicinal agent, this root was first brought into notice nearly a century ago, by Dr. John Tennant, who discovered that it was the secret remedy of the Senagaroo Indians against the bite of the rattlesnake; and, from the similarity of the symptoms of the bite of that reptile and those of pneumonia, he recommended it in that affection. It operates chiefly as a stimulant to the capillary system; and consequently influences the function of the skin and the secreting organs in general. As an Emmenagogue, Senega root was first employed by Dr. Hartshorne, of Philadelphia. He found that its efficacy is most conspicuous in recent cases of amenorrhœa, when it is administered in the form of a saturated decoction, to the extent of a pint in twenty-four hours, beginning its use about two weeks previous to the menstrual discharge. It is, however, necessary to state, that he previously prepared the habit, as he expressed himself, by the administration of calomel, carried to the extent of producing a gentle ptyalism; and something must be referred to the action of the mercurial on the uterus, independent of the Senega. The experience of Dr. Chapman, another American physician, and Professor of Materia Medica in the University

of Pennsylvania, is thus stated by him. "I have," says he, "tried the Senega, both in my public and private practice, to a considerable extent, and with sufficient success to warrant me in recommending it as one of the most active, certain, and valuable of the Emmenagogues. The Senega," adds Dr. Chapman, "may be used either in powder or in decoction, though I greatly prefer the latter mode. My rule," he says, "in the administration of the medicine, in these cases, is to give about four ounces of the decoction, more or less, during the day, according to the circumstances of the case. But at the time when the menstrual effort is expected to be made, and till the discharge is actually induced, I push the dose as far as the stomach will allow, having given as much as two ounces every hour."

"In the intervals of the menstrual periods," Dr. Chapman continues, "I always lay aside the medicine for a week or two, as, without these intermissions, if it does not lose its efficacy, it becomes nauseous and disgusting to the patient. While under a course of Senega, the general system is to be kept properly regulated, equally obviating excessive excitement or debility, by the use of the appropriate remedies. Of all the Emmenagogues which I have tried," he adds, "this is the most efficacious, and will be found useful in all the forms of amenorrhœa; but I think it to be more particularly so in those cases where decidua exist. As yet we are ignorant of the exact process by which this membrane is formed; though of this there is no doubt, that the vessels of the uterus, which pour out the catamenia, are the instruments by which it is accomplished. Nor is it less certain that, while they are engaged in the formation or support of this new production, menstruation ceases, the two offices exciting modes of action totally incompatible. It is obvious, under these circumstances, to change the state of the uterus and to excite to a secretory effort, not only a forcible, but a specific impression must be made upon it. Deny to the Senega these specific energies, and where shall we seek an explanation of its effects? Were it simply a stimulant or tonic, or sudorific, as is more generally supposed, it might induce excitement, or impart tone, or raise a diaphoresis, like many other arti-

cles of the Materia Medica ; but would it be so signally efficacious as an Emmenagogue ?" I have ventured to extract this long quotation from Dr. Chapman's work on Materia Medica, to make up for the want of any remarks which my own experience enables me to make on the employment of this medicine in the treatment of amenorrhœa ; and I am the more induced to offer it for attentive consideration from the justness of the reasoning it contains. If his remarks be correct, the Senega root is undoubtedly an Emmenagogue which merits more attention than it has received on this side of the Atlantic.

2. RUE. *Rutæ graveolentis folia.* L. E. D.—This plant is a native of the South of Europe, although it is generally cultivated in this country as a garden shrub. It belongs to the natural order Rutaceæ. It was esteemed as a useful remedy in obstructed menstruation so early as the time of Hippocrates, yet, it is of doubtful efficacy. It is more employed on the Continent than in this country. If it be used at all, the oil should be preferred to the plant. In the form of an oleo-saccharum, the oil may be administered to the extent of two or three minims for a dose.

** *Leaves.*

3. SAVINE LEAVES. *Juniperi Sabinæ folia.* L. E. D.—Savine is a native of the South of Europe, belonging to the natural order Coniferæ. It is a low, branching, evergreen shrub, with a dark-brown bark, and small, opposite, firm, needle-shaped leaves, of a dark-green hue. The male flowers are on one plant, the female on another. The *male* catkin consists of a triple row of bracteated florets, and a terminal or tenth floret, in which only the anthers are supported on stamens. In the *female* flowers, which are furnished with calyx and petals, the germen supports three united styles with simple stigmas. The fruit is a spurious, fleshy cone.

The leaves of Savine have a strong, disagreeable odour, and a hot, acrid taste, both depending on a volatile oil, which can be obtained separated from all the parts of the plant by distillation with water. Savine, or rather the volatile oil of

the plant, is an energetic Emmenagogue; and, from the activity and mode of its action, and its proneness to produce uterine hæmorrhagy, there is reason for thinking that it is taken into the circulation and carried directly to the organ, on which it exerts a stimulant influence. This is not a recent opinion; for, previous to the introduction of the ergot of rye, this plant was sometimes employed for the purposes of accelerating parturition and expelling the placenta. Experience has amply confirmed the power of Savine as an Emmenagogue; but it has also proved that much caution is requisite in its administration, to prevent inflammation of the uterus; and consequently, also, that it is adapted for those cases of amenorrhœa only which are attended by a pale countenance and languid circulation. More than half a century ago, it was lauded as an Emmenagogue by Dr. Home; but, from the opinion of it expressed by Dr. Cullen soon afterwards, it was neglected, and has never since regained its reputation as an Emmenagogue. M. Herz, a German writer, has also borne testimony to the beneficial influence of Savine as an Emmenagogue. It may be administered in substance, in the form of powder, in doses of from five to ten grains; or the oil may be given as an oleo-saccharum, in doses of from two to six minims, combined with from ten grains to a scruple of sugar. The Dublin College orders an extract of Savine; but it is useless, as the volatile oil, the active principle, is dissipated by the boiling.

** *Inorganic Products.*

MERCURIAL PREPARATIONS. *Hydrargyri Preparationes.* —No medicines, perhaps, merit more the appellation of direct, mediate Emmenagogues than the preparations of mercury.

If the correctness of the view which has been taken of the function of the uterus be admitted, there is little difficulty in conceiving that the administration of mercurials in obstructed or suppressed menstruation is likely to prove salutary. They operate almost a specific change upon the whole glandular system; and, consequently, regarding the uterus as a gland, if its functions be altered by disease, the same medicines

which affect the capillaries in general are likely to operate on those of the uterus, when they are in a morbid condition. Mercurials, carried to the extent of exciting a moderate degree of salivation, have relieved amenorrhœa when every other method of treatment has failed.

If we reflect upon the general influence of mercurials in stimulating the capillaries, and the manner in which they are thrown off by the skin, we can scarcely doubt that they are carried into the circulation, and applied directly to the uterus. The preparation best suited for this purpose is Calomel, the Protochloride of Mercury; it is mild in its operation, and at the same time it is one of the most certain in its influence on the general system. In the combination in which it exists in Plummer's pill, in particular, it has been found highly beneficial, the precipitated sulphuret of antimony with which it is combined greatly aiding its power. It may be given in doses of from gr. v to gr. xii every night and morning, until the gums be sensibly affected.

Upon the whole, from what has been said, it is obvious that Electricity is the only direct Emmenagogue, and that the idea of the others acting upon the uterus itself is rather inferred than certain. It is nevertheless true, that, in whatever manner they act, Emmenagogues stimulate the uterus; and, therefore, some caution is requisite to be observed in their administration. We must be certain, in the first place, that the suppression is not connected with pregnancy: in such a state it would be highly injurious to prescribe direct Emmenagogues; as not only abortion may be induced, but inflammation may be set up, and lay the foundation of an organic disease of the uterus. There is often, indeed, much difficulty in deciding upon the propriety of employing direct Emmenagogues, even when the suppression is not connected with pregnancy: the uterus may be in such a state of active disease as to render their influence upon it extremely hazardous.

B. INDIRECT EMMENAGOGUES.

These consist of substances which influence the uterus through the medium of some other organ. This may be effected in three ways:—

1. By the substance operating on the kidneys or intestinal canal, and stimulating the uterus by proximity.

2. By the substance operating on the stomach and improving the general health, so that the uterus may share the salutary influence.

3. The uterus may be specifically influenced through the medium of the nervous system.

1. *Substances operating on the Kidneys and Intestinal Canal.*

The substances which produce emmenagogue effects, by their operation on the kidneys and intestinal canal, are some diuretics which pass to the kidneys undecomposed, and cathartics which especially stimulate the rectum.

a. Nitrate of Potassa. *Potassæ Nitras.* L. E. D.—In some experiments made upon women forming part of a society established at Leipsic for therapeutical purposes, Nitrate of Potassa was found to possess decided emmenagogue powers when given in doses of from ℈i to ʒi, dissolved in any bland fluid. I have had no experience of its influence as an Emmenagogue.

b. BITTER PRINCIPLE.

Aloës. *Aloës Spicatæ vulgaris.* L. E. D. — The aloëtics (vol. ii, p. 298), we know, have the property of stimulating the rectum; and in treating of Aloës, as a purgative, I stated that its specific action on the rectum had been referred to its slow solution; but I pointed out that this could not explain it, since Aloës applied to a wound operates on the large intestines in the same manner as when the drug is taken into the stomach. Their influence on the uterus can only be referred to their action on the rectum; and its extension to the uterus producing a state

of the organ closely allied to that which is the result of the application of a direct stimulus. The powerful sympathetic influence of aloëtics is well illustrated by the effect which frequently follows their administration after the total cessation of the catamenia. For some time after this event takes place, the uterus retains the disposition to resume that state of vascular action which determines the periodical discharge. In this condition of uterine susceptibility, the excitement of the rectum by an aloëtic purgative almost invariably induces the return of the menses in a slight degree, provided the purgative be given at the period when the discharge had previously been accustomed to appear. Now, if a cathartic is capable of producing so powerful a sympathetic action, when this uterine function has ceased to be any longer essential, we can readily imagine that a more powerful effect is likely to be the result of a similar extension of action from the rectum to the uterus, at a period of life when the susceptibility of impression must necessarily exist in a high degree. Experience has sufficiently demonstrated that such an extension of action really occurs. In prescribing Aloës, however, as an Emmenagogue, the cause of the suppression must be kept in view, for this medicine cannot be safely administered in an irritable state of the uterus.

To secure the emmenagogue effect of Aloës, it is supposed necessary to administer it in a solid form, owing to the idea which I have already mentioned, that its effects on the rectum depend on its slow solution; but, as already stated, I am of opinion that this supposition is founded on a mistaken idea of its mode of acting: it is equally efficacious whether given in the solid or the fluid state; and indeed I have seen it most generally successful when administered in combination with alkalies, which greatly aid its solubility. The administration of a pill composed of a grain of Calomel, the same quantity of Foxglove, with two or three grains of the extract of Conium, at bed-time, followed in the morning by half an ounce of the vinous solution of Aloës and Myrrh, in conjunction with the carbonates of soda and of ammonia*,

* London Dispensatory, 6th edition, p. 941.

for two or three days previous to the expected return of the menstrual discharge, has in my hands generally proved successful.

Aloës forms a component of eighteen preparations in the British Pharmacopœias. Those in which it is combined with myrrh or with assafœtida, under the title of Pilula Aloës c. Myrrha, and Pilula Aloës et Assafœtidæ, are the most useful as Emmenagogues.

c. GUM RESINS.

These substances exist in vegetable bodies; but two only are employed as Indirect Emmenagogues—the root of the black Hellebore and Camboge.

1. ROOTS OF BLACK HELLEBORE. *Hellebori Nigri Radix.* L. E. D.—This drastic cathartic has been found useful as an Emmenagogue in phlethoric habits, probably from its influence in reducing that state of the system which is as adverse to the secretory action of the uterus as to that of every other glandular organ. The Black Hellebore was introduced into practice, as an Emmenagogue, by Dr. Mead, who pronounced a high eulogy on its powers; and it continued to be much employed until doubts of its efficacy were raised by Cullen and Heberden*, after which it fell into disrepute; but it is still much prescribed on the continent of Europe and in the United States of America. Dr. Chapman thus expresses himself respecting it:—"It has many just pretensions. It is especially useful when it purges, in painful menstruation, attended with torpor and constipation of the bowels, and perhaps with some degree of insensibility in the uterus itself. The powder," he adds, "is given in doses of ten grains, in the form of pills, which may be repeated for several days†." How far its action as an Emmenagogue can be relied upon, my experience does not permit me to offer an opinion. From the violence of its action as a purgative, it

* Heberden remarks, "Radix Hellebori Nigri facultatum movendi menstrua sibi vindicavit, quam tamen nullo satis firmo argumento usus mihi confirmavit. Commentarii, cap 62.

† Materia Medica.

requires to be administered with caution. If it be employed, the tincture is the best form of preparation: it possesses all the active properties of the root, and may be added to any purgative, and thus aid in stimulating the uterus with less risk than is likely to attend the use of the root or its infusion. The extract of the Edinburgh Pharmacopœia, in doses of from gr. iv to gr. x, in combination with extract of Conium, has been found useful in the amenorrhœa of chlorotic females.

When Black Hellebore has been overdosed, it has in several instances proved fatal. The symptoms are pains in the stomach and violent vomiting. Post-mortem examinations have displayed appearances of inflammation in the alimentary canal sufficient to account for death. Cupping over the scrobiculus cordis, and other active antiphlogistic measures, are the means requisite to counteract these effects.

2. CAMBOGE. *Gambogia.* L. E. D.—Although this substance is supposed to be the proper juice of the Stalagnistis *cambogioides*, yet this is by no means certain. It gripes more than Aloës, and is as drastic in its operation as hellebore; and, therefore, as it possesses no peculiar advantages to secure it a place in the list of Emmenagogues that I know of, unless it be as an auxiliary to other purgatives, it might be advantageously rejected.

2. *Indirect Emmenagogues operating on the Stomach.*

Emmenagogues which operate through the medium of the stomach are tonics of a stimulant character, those which owe their efficacy to volatile oil; and the salts of iron.

* *Organic Products.*

d. VOLATILE OIL.

* *Roots.*

2. SERPENTARIA ROOT. *Radix Serpentariæ.* L. E. D.—(Vol. i, p. 191.) This stimulant tonic produces emmenagogue effects by the influence it exerts on the capillary system. It is given in the same dose and under the same circumstances as when it is employed as an excitant.

1. VALERIAN ROOT. *Radix Valerianæ.* L. E. D.—The species which yields this rhizome, improperly termed a root in the Pharmacopœias, has been regarded as the plant described by Dioscorides; but Dr. Sibthorp, in his Flora Græca, has clearly demonstrated that this opinion is erroneous, and has given an excellent figure of the Valerian of the ancients, the V. *Phu* of Dioscorides. The genus belongs to the natural order Valerianeæ; the species used is the Valeriana *officinalis*, an indigenous plant*.

The roots of Valerian, as they are termed, consist of long, slender fibres, issuing from tubers. They have a strong, peculiar odour, and a warm, bitter, subacrid taste. Tromsdorff analyzed the roots of Valerian†. When distilled with water, they yield a liquid, greenish-white, volatile oil, on which their properties chiefly depend. This oil, which has a strong odour of camphor, becomes yellow and viscid on exposure to the air; and forms with nitric acid an orange-yellow resin, having a powerful odour. The oil is lighter than water; its sp. gr. being 0.934. Sixteen ounces of the dried roots, analyzed by Tromsdorff, yielded ℥ii of a peculiar principle; ℥i of a black resin; ℈i of volatile oil; ℥iss of gummy extract; ʒv of fecula; and ℥vi ℈ii of woody fibre. The peculiar principle here alluded to is soluble in water, but not in alcohol, nor in ether. It does not appear to be the active principle of the medicine. The action of reagents on the aqueous infusion of Valerian shews the presence of a free acid, tannin, extractive, and fecula. Alcohol, however, takes up all the active principles of the root. The tincture is not decomposed by water; but all the mineral acids render it milky, even when it is largely diluted with water.

The roots of Valerian, even in their growing state in the ground, have a powerful attraction for cats, who are intoxicated by gnawing them in the dry state. They are sometimes adulterated with the roots of a species of Ranunculus; which, although they have a bitter, caustic taste not present in Valerian, yet are not easily detected. The roots of Va-

* Woodville's Med. Bot. 3rd edit. p. 97, pl. 32. London Dispensatory, art. Valeriana.

† Bulletin de Pharm, t. i.

lerian suffer in their medicinal powers from being taken up at an improper season, and from not being carefully preserved.

Valerian appears to exert its influence on the nervous system, first as a stimulant, and afterwards as a sedative. On these properties its influence in relieving spasm certainly depends; but, nevertheless, it is not regarded as a narcotic. Dr. Heberden states that he has seen persons thrown into strong agitations by its use, and, from its effects upon cats, he is disposed to admit its influence on the nervous system to be considerable. Its influence, nevertheless, is not uniform, but is greatly affected by circumstances; thus, from ʒii to ʒviii of the powder have been taken by some individuals without producing any effect, whilst the same quantities of the same powder have caused in others manifest powerful action on the brain and on the intestines; displayed by a sensation of weight in the head, and a sense of fulness in the alimentary canal, flatulence, colic, and tenesmus. To such individuals Valerian ought not to be administered; and it may also be laid down as a general rule, that it is contraindicated in congestion of the brain. It can only be from its antispasmodic influence that Valerian proves useful in amenorrhœa; and thence we must admit the muscular nature of the uterus, and its susceptibility of irregular action by which its function is disturbed and suspended. Experience has amply demonstrated the value of the Valerian in amenorrhœa, in hysterical females: but whether the benefit be derived from its influence on the general system, and the uterus sympathizing with it, or whether it have any direct action on the organ itself, admits of a question. Its employment, except in cases of uterine irritation, is not very extensive.

Valerian is sometimes administered in substance, in combination with aromatics; but the great quantity of inert woody matter contained in the root would lead us to regard the powder as a bad form, on account of the largeness of the dose, less than ʒi scarcely ever producing any effect. It is only in this form, however, that Valerian operates on the abdominal viscera. An extract of it is ordered by the Dublin College; but the volatile oil being dissipated in preparing it, this, like all extracts of plants containing volatile principles,

is objectionable. As water takes up all the active principles, the infusion might be supposed to be an excellent form of administering Valerian. But the effects of the infusion are much less permanent than those of the powder; and in this form Valerian seems to operate chiefly on the nervous centres. There are two tinctures of Valerian; one made with alcohol, the other with the aromatic spirit of ammonia: both are frequently ordered in conjunction with bitter infusions; but neither can be properly combined with decoctions of astringent vegetables, especially of yellow bark, as an insoluble precipitate is produced, by which the efficacy of both medicines is lessened. The alkaline wine of aloës is the most useful addition to Valerian when it is administered as an Emmenagogue.

* * *Herbs.*

3. COMMON WORMWOOD. *Artemisiæ Absinthii summitates.* L. E. D.—Wormwood is an indigenous plant, which belongs to the natural order Compositæ, and is diffused very generally over the surface of the globe. It has a strong, disagreeable odour, and impresses a slightly bitter aromatic taste on the palate. These qualities are given out both to water and to alcohol, and a green volatile oil is procured by distillation with water, on which the virtues of the plant appear to depend. The aqueous infusion is precipitated by sulphates of iron and of zinc, and the acetates of lead, but not by tartrate of antimony and potassa. It may be administered either in the form of powder, in doses of from ℈i to ℈ii; or in that of infusion, made with ℥i of the dried plant and f℥xii of boiling water, of which f℥iss may be given for a dose. The Dublin Pharmacopœia contains an extract of Wormwood; but if the powers of the plant depend on its volatile oil, it is scarcely necessary to say that this is a bad form of the preparation.

As an Emmenagogue, Wormwood is much inferior to either valerian or serpentaria. It has been administered, however, with advantage in cases of amenorrhœa depending on diminished energy of the uterus, in hysterical and hypochondriacal individuals. Its anthelmintic properties are more generally known and less equivocal than its emmenagogue.

** *Inorganic Substances.*

The Inorganic Substances employed as indirect Emmenagogues, producing their effects by their influence on the stomach, are preparations of iron, both natural and artificial.

1. NATURAL SALTS OF IRON.

The natural salts of iron, employed as indirect Emmenagogues, exist in a state of solution in waters constituting what are termed *Chalybeate Waters.* All these waters are styptic to the taste, and strike a blue-black with infusion or tincture of galls, and a blue with ferrocyanate of potassa. The iron is generally in the state either of a carbonate dissolved in carbonic acid, or of a muriate or a sulphate. The principal waters of this description in this country, are those of Tunbridge, Brighton, Cheltenham, Sandrock in the Isle of Wight, and Peterhead. The Bath waters also contain a small quantity of Iron. In the waters of Tunbridge and Cheltenham, the Iron is held in solution by carbonic acid, which exists in the Tunbridge waters in the proportion of eight cubic inches in each gallon. The Iron is contained in the state of a carbonate ; but when the water is exposed to the air, the carbonic acid escapes, and the oxide of iron attracting an additional portion of oxygen, and being thus converted into a peroxide, it becomes insoluble, and is precipitated in the form of a red or ochreous deposite. On this account, these waters are most beneficial when drank at the spring ; or, if they be conveyed to a distance, they should still afford the inky colour when tested with infusion of galls, otherwise they are of no value as Emmenagogues. The other ingredients in chalybeates of this description, are minute quantities of sulphate of soda, muriates of soda, of lime, and of magnesia, and carbonate of lime, which produce no effect on the uterine system. The Peterhead spring resembles those of Tunbridge and Cheltenham.

In the Brighton and Sandrock springs, the Iron is contained in the state of a sulphate. These waters are not decomposed by exposure to the air ; and, even after being boiled, they answer to the tests of the presence of Salts of Iron, the infusion of galls, and ferrocyanate of potassa.

Both these kinds of chalybeate waters operate as powerful stimulant tonics, although, in neither, the Salt of Iron exceeds three grains in a gallon of the water. Soon after drinking the usual dose, half a pint, of any of them, the pulse rises in strength, and a glow is felt over the frame. In plethoric individuals, nausea, vomiting, pain of the præcordia, a sensation of weight in the head, slight vertigo, and a feeling of general fulness, are frequently experienced on first drinking the waters; and, if these symptoms do not abate, the use of them should either be discontinued altogether, or should be intermitted, and the patient be bled and purged before their use is resumed. All the varieties of chalybeate waters prove useful in amenorrhœa, connected with a pale, leucophlegmatic, or chlorotic state of the habit. Their influence is on the secretory system, on which they operate in a slow, but uniformly progressive manner, imparting tone, nervous energy, and general vigour; and in these benefits the uterus shares. In commencing a course of chalybeate waters, if the tongue be furred and the bowels irregular, indicating a disordered state of the alimentary canal, a gentle emetic and a purgative should be administered before taking the waters; and, when the habit of the patient is sluggish, pilula aloës cum myrrha may be administered with each dose of the water. The whole quantity of the water necessary to be taken in one day should be drunk in divided doses, between each of which brisk walking exercise should be used.

The beneficial effects of these natural solutions of the Salts of Iron in chalybeate waters most probably depend on their very minute division; but this is not the sole cause, as no artificial imitation of a chalybeate water, however accurate, produces beneficial effects equal to those of the natural springs. It must also be noticed, that these waters are most successful when they are drunk at the fountain-head—a fact which throws considerable light on the cause of the superiority of the natural waters over their artificial imitations. Certainly it is not in towns, in the busy haunts of men, amidst anxieties and rankling cares; nor in situations which tempt us to join in the dangerous enjoyments of the festive

board, nor while attending the nocturnal assemblies of heated drawing-rooms, or the crowded theatre; that any remedial agent can be expected to produce a salutary effect: and, therefore, we cannot wonder that a chalybeate drunk at a distance from the well, in such an unnatural condition of life, produces a less salutary effect than when taken at the spring.

2. ARTIFICIAL SALTS OF IRON.

The tonic effects of Iron in combination with those agents which give activity to metals, oxygen, chlorine, and acids, have been acknowledged, and are verified by every day's experience. Its salts have been long known as well adapted for cases of amenorrhœa, connected with a feeble state of the general frame. All the preparations of Iron, indeed, are useful Emmenagogues.

A common form of administering Iron in amenorrhœa, is that of the BLACK OXIDE of the Edinburgh and Dublin Colleges, the scales from the anvil of the smith, purified. This is a compound of two oxides of Iron, united in uncertain and inconstant proportions. It is always formed when Iron is heated to a high temperature in the open air, but the oxides vary with the duration of the process and the temperature employed. The protoxide in the preparation of the Black Oxide, from its combining with the acid of the stomach and giving out hydrogen gas, in decomposing the aqueous contents of that organ, has the inconvenience of producing acid eructations. The dose is from gr. v to ℈i, two or three times a day. It may be combined with aromatics.

One preparation of iron has been introduced into the London Pharmacopœia, expressly with the view of improving the preparations of iron as Emmenagogues—the LIQUOR FERRI ALKALINI. L. It is rarely used and cannot be administered in any aqueous infusion or decoction without being decomposed, the peroxide of iron being precipitated, and nothing but the subcarbonate and nitrate of potassa remain in the water. The FERRUM AMMONIATUM is not more valuable. The most efficacious preparations as Emmenagogues are the CAR-

BONATE, the SULPHATE, and the TINCTURE of MURIATED IRON. The Carbonate and Sulphate may be combined with myrrh, aloës, or galbanum; the Tincture of Muriated Iron may be added to any tonic bitter which does not decompose it; as, for example, infusions of quassia, gentian, and cascarilla. The sulphate should always be in the form of the protosulphate; and, therefore, as this salt is rapidly converted into the persulphate when kept in the usual manner, it should be preserved in alcohol. None of the preparations of iron is so injudicious as the compound mixture of iron of the London and Dublin Pharmacopœias. It is intended to produce in this preparation a carbonate of iron, suspended in the mixture by the gummy matter of the myrrh: but if the bottle containing it be not quite full and be not kept completely closed, oxygen is rapidly attracted from the air, and the carbonate is as rapidly transmuted into the insoluble and consequently inert peroxide of iron. This is readily demonstrated by the change of colour which takes place in the mixture when exposed to the air. When made at the time it is to be used, however, this mixture is an excellent tonic Emmenagogue in doses of f℥iss, given twice or three times a day. The quantity of the protosulphate proper to mix with f℥iss of the mixture of myrrh and carbonate of potassa is four grains. Its influence is perceived by the rapid change which it induces on the alvine and renal evacuations; the black colour of the former, and the blue streak when the latter is tested with ferrocyanate of potassa, demonstrating that the chalybeate has entered the circulation.

3. *Indirect Emmenagogues operating on the Nerves.*

* *Animal Products.*

e. CASTOR (vol. i, p. 611) has been regarded as a beneficial Emmenagogue when the suppression of the catamenia is connected with spasm and hysteria. Were I to form an opinion of Castor from my own experience, I would not regard it as an Emmenagogue of any value; and this opinion is borne out by the experiments of Dr. Alexander. He affirms that it produces very little sensible effect upon the

habit in much larger doses than those in which it is usually given; and he consequently condemns it as a useless and inert substance.

** *Vegetable Products.*

f. OLEO-GUM RESINS.

1. ASSAFŒTIDA, L. E. D., (vol. i, p. 616) must be regarded rather as a useful addition to other Emmenagogues than as itself capable of stimulating the uterine organs. Its impression on the uterus depends solely on its influence on the alimentary canal, which it stimulates through the whole length when it is administered in doses from gr. v to gr. xv. Perhaps in no case should the dose exceed one grain.

2. GALBANUM. L. E. D.—The plant which yields this oleo-gum resin is, according to Dioscorides, a native of Syria; but it is remarkable that the numerous travellers who have visited that country have not met with it. As the drug is imported from Smyrna and partly from India, "it is very probable," says Mr. Don, "that the plant is also a native of India." From the examination of the seeds found in the drug, Mr. Don is of opinion that it is not the production of the Bubon *Galbanum;* he has therefore named the plant Galbanum *Officinale*, and informs us that the genus is nearly allied to *Siler**.

As an Emmenagogue, Galbanum closely resembles Assafœtida.

g. DIGITALIS. *Digitalis folia.* L. E. D.—(Vol. i, p. 578.) The influence of Foxglove on the generative organs is undoubted. In men, it causes erections and pollutions; in women, it produces symptoms very closely resembling those which indicate the approach of menstruation; and one of the effects of an overdose is inflammation of the genital organs in both sexes. Had Foxglove not been employed as an Emmenagogue, these facts would be sufficient to authorize its administration for awakening the energy of the uterus. I have long been in the habit of ordering it in doses of from gr. i to gr. iii, combined with calomel and followed by an aloëtic cathartic on the following morning, with almost unvarying

* Linnean Transactions, 1832.

success, in suppression of the catamenia. It is scarcely necessary to say that its use need not be continued many days after the period of the monthly change, and that it is productive of the greatest benefit when it is given, for two or three successive days, anterior to the time when the change should occur. The tincture, for reasons formerly stated, is the best form of administering the medicine.

h. ERGOT OF RYE. *Secale Cornutum.*—According to Decandolle, the Ergot is a parasitic plant belonging to the natural order Fungi. It grows on the ear of the rye, barley, and wheat; and, from its appearance, is known by the name of the *Spur*. It is, however, more common upon the rye than upon other grains, and thence the appellation Secale *cornutum*. Decandolle conceives that it is a sclerotium, and has imposed upon it the name Sclerotium *clavus*. But, notwithstanding the high character of Decandolle as a botanist, I am more disposed to think, with Fontana, M. Virey, and others, that it is not a fungus, but a disease of the grain itself, probably, as conjectured by Gen. Martin Field, from the puncture of an insect. The diseased grain still preserves some of its characters; and it is not improbable that the change is chiefly in the conversion of the fecula of the grain into a kind of mucus; but the gluten, also, undergoes a change, and a peculiar oil and ammonia are developed, prone to putridity.

The Ergot is a nearly cylindrical, curved, striated body, of a deep violet colour on the exterior and whitish within. When examined by a powerful microscope, the exterior coat seems to be a violet-coloured mass, sprinkled with white dots; the interior exhibits white, brilliant grains resembling starch. It is inodorous, has a mawkish, peculiar taste, and burns as if it contained oil. It imparts its colouring matter and properties to water and to alcohol. The Ergot is specifically lighter than water, whereas sound rye is heavier than water. Vanquelin analysed Ergot, and procured—1. two colouring principles, one fawn, soluble in alcohol, the other violet, analogous to litmus, but insoluble in alcohol: 2. a sweetish oleaginous matter: 3. a free acid, probably the phosphoric: 4. free ammonia: 5. a vegeto-animal matter, strongly disposed to putridity. None of the usual components of the Rye,

starch, gum, sugar, or gluten, are found in it*. When eaten in rye bread, in years in which it greatly abounds, it produces a peculiar, diseased state of the habit. This disease, which is somewhat similar to dry gangrene, was known to Galen. It was epidemic in Silesia, in 1096, and again in 1588. The symptoms attending it are weakness of the lower limbs, amounting almost to paralysis, vertigo, indistinct vision; the pulse small and weak at the wrist; pains in the legs and arms; sometimes lividness in the foot and toes, which terminates in gangrene. The breathing is greatly oppressed, the bowels are but little affected, the tongue is slightly coated, and the face assumes a livid hue. Dissections of this disease have presented an unusual deposition on the adipose membrane on the surface of the peritoneum, dark or livid spots on the intestines, traversing the arch of the colon and descending to the sigmoid flexure and the rectum. The stomach is slightly inflamed and discoloured on the under and larger portion.

The secale cornutum, when taken by either sex in the ordinary state of the habit, produces a disagreeable sensation, resembling formication in the feet, which is speedily followed by strong contraction of the muscles and spasms of the limbs, pain of the head, vertigo, delirium, and opisthotonos, or contractions of the muscles of the loins and back, which force the body into a curve backwards, so that the occiput approaches to the hips. It evidently, therefore, acts through the medium of the motor nerves, and chiefly on the extensor muscles. The question naturally arises—to what does it owe this influence over the extensor muscles? Does it contain an alkaloid resembling strychnia? Chemical examination has not authorized such a supposition. The aqueous solution or infusion is of a reddish colour, and evidently contains a free acid, which is certainly not gallic acid, but which Vauquelin supposed to be phosphoric, from its fixedness and from its action on lime water, barytic water, nitrate of silver, and acetate of lead. It contains much extractive matter, a copious precipitate being afforded by muriate of tin; and it

* Journ. de Chim. et Phys. t. iii.

also contains a small quantity of ammonia, which is liberated at the heat of boiling water. Muriatic acid develops a colour which it does not evolve in rye flour.

From the result of these experiments, no satisfactory inference can be drawn regarding the active principle of Ergot; let us, therefore, inquire what pretensions it has to the character of an Emmenagogue. The chief use to which secale cornutum has hitherto been applied is to produce uterine action, to aid the efforts of parturition when these are insufficient for the expulsion of the child. For this purpose, it is administered in doses of from ℈i to ʒss, bruised and mixed in f℥ii of water, and administered at short intervals until the effect is produced. Ample experience has proved the efficacy of Ergot to expel any substance from the uterus when it is in a state of complete inactivity during the process of parturition. Now, admitting this to be true, these premises are not sufficient to admit the conclusion that it will also aid the menstrual discharge when scanty or suppressed.

Dr. Hall, an American physician, who has written on the use of the Ergot in parturition, is of opinion that it is taken into the circulating mass, and, acting as a sedative, produces a state of asphyxia in the fœtus, and such a condition of the uterus as renders it incapable of longer sustaining the child; and, therefore, this tendency in the mother brings on speedy efforts of the animal œconomy to save both mother and child. I confess that this view of the subject is quite incomprehensible to me; and the only idea I can form of the influence of Ergot is that it acts as a specific excitant to the parturient uterus, causing contraction in it and consequently expelling the child. The correctness of this idea is supported by the fact that its administration has been found to be hazardous until the regular pains have ceased and a perfect relaxation has been induced. In this state, it excites again the uterine action; and, from the relaxation of the resisting parts, the obstacle these present to the expulsion of the child in parturition is easily overcome, and expulsion is the consequence. That this is the effect of regular muscular contraction in the stimulated organ may also be reasonably inferred from the feelings described by women who have taken it during labour.

The sensation is not that of pain, but a constant nisus is kept up, goading, as it were, the uterus ; and, during the contraction, the women describe the sensation to be "as if every thing were forcing from them."

With respect to the influence of Ergot, nothing favourable can be said. If the uterine discharge, the menstrual fluid, arise, as I suppose, from the secreting action of the uterus, it is easy to conceive that the cause which operates in exciting the expulsion of a child, would be likely, by operating on the muscular contractility of the uterus, to check rather than to accelerate the flow of the menses ; for, by constringing the vessels from the general contraction of the organ, and thereby preventing that due supply of blood which is requisite for the performance of the secreting function, it is evident that the secerning function of the organ would be impeded. Experience has proved that it has, indeed, very slender pretensions, if any, to the character of an Emmenagogue. This has been attributed to its transitory effects; but I am more disposed to assign it to the powerful contractions that it excites in the viscus: and on this account it has been found highly serviceable in restraining uterine hæmorrhage, both before and after delivery. It has also produced beneficial effects in cases of leucorrhœa, attended with emaciation and a pale, blanched state of the surface, with much debility, when given in doses of gr. v to gr. x, three or four times a day. Upon the whole, as far as I am able to form an opinion from the description of its effects, in the act of parturition, given by writers who have had great opportunities of judging of it, I am disposed to expel the Secale cornutum from the list of Emmenagogues. Its influence, however, upon the uterine and urinary organs is undoubted. In two cases of paraplegia, its use was followed by involuntary emissions of semen. Professor Dewes, of Pennsylvania, has laid down the following rules to be observed during its employment in parturition :—

1. It should never be given before the membranes are ruptured, the os uteri dilated, and the external parts disposed to yield.

2. It should not be used so long as the natural pains are efficient and competent to the end.

3. But should they flag from any cause, it may be given, provided the labour be a natural labour; that is, when the head, or the feet, or the breech, or the knees, are presented.

4. If flooding, syncope, or convulsions, take place, it may be employed to great advantage, if the first and second rules be not violated.

5. It is useful in every kind of premature labour; and at the full time, when the placenta is not thrown off, and the uterus is in a state of atony.

6. When floodings occur after the rupture of the membranes, if the os uteri be well dilated, and the child well situated, and the pains are feeble.

7. When the head of the child, separated from the body, has been left in the uterus.

8. When the uterus is painfully distended by coagula.

The dose of the Secale cornutum, in the cases in which it is indicated, should not exceed thirty grains. The medicine should be preserved entire in a glass bottle with a ground stopper, and powdered only at the time it is to be given; and then it may be administered in a glass of wine, which Dr. Balardini has found to be preferable to water. Heat and moisture tend to spoil it. It should always be the growth of the year in which it is prescribed.

Except Electricity, there is much uncertainty attending the employment of Emmenagogues. I hope the manner in which I have endeavoured to trace their modes of acting will tend to place their administration on rational principles. The importance of the catamenia in preserving the health of the female habit, is undeniable; and, therefore, every thing that can tend to maintain its regular return, and to promote its due quantity, is of great importance in a practical point of view. In every chronic complaint of a female it is requisite to ascertain the state of the catamenia: but, before advising

any medicine for the purpose of influencing the uterus in any manner, the cause of the suppression or the irregularity, of whatever description it may be, must be minutely investigated. Without obtaining such a knowledge of the state of the organ, and ascertaining how far the suspension or irregularity is due to the condition of the organ itself, or to the general system, our practice must ever be uncertain: in floundering about and trying various remedies, without rule or discrimination, we may, it is true, stumble by accident upon something effectual; but much evil may be previously produced.

SECTION XVII.

DIAPHORETICS*.—MEDICAMENTA DIAPHORETICA.

Syn. Sudorifica.

Diaphoretics are "medicines which augment the function of perspiration." In order to understand their mode of operation, we ought to possess an accurate idea of the nature of the cuticular function, and of its effects in a state of health.

The skin, which is the organ of perspiration, consists of three layers, the *cuticle*, the *reticulum*, and the *corium*.

The *cuticle*, or exterior layer, is little organized, and is destitute of both vessels and nerves. It nevertheless resists suppuration and even maceration for a long time, and, when destroyed, it is very quickly reproduced. It has no obvious pores, but permits a ready passage to caloric, carbon, hydrogen, oil, acids, and watery vapour. Anatomists and physiologists differ greatly with regard to the nature and formation of this portion of the skin. According to the prevailing opinion, it is a homogeneous, inorganic matter, spread like a varnish over the surface, an exudation of the parts beneath it. Lewenhoek imagined it contained pores: Humboldt could detect no pores in it by means of a microscope which magnified

* From διαφορεώ, differo, discutio, derived from δια, through, and φερω, I carry.

312,400 times: the passage, therefore, of matters through it must be the result of simple imbibition. It is united to the corium or true skin by the *reticulum*, a fine mucous net-work, first noticed by Malpighi. Neither nerves nor vessels have been observed in the reticulum. In Europeans it is colourless, and its existence in the white races has been denied; but it is coloured and obvious in Negroes and the coloured races of mankind. It appears to be the connecting medium between the cuticle and corium. The *corium* or true skin is a tough, very extensible membrane, varying in thickness, formed of dense fibres crossing and interlacing one another, and through the openings or meshes of which pass capillary bodies, consisting of the sentient extremity of a nerve surrounded by a plexus of blood-vessels. It is furnished also with numerous sebaceous follicles, which secrete and diffuse an odorous oil over the skin. In a state of health, this oil is thin and limpid: in disease, it is viscid and greasy.

The importance of perspiration for the preservation of health is well understood; but the laws which regulate it are still imperfectly determined. It is a general function of the skin; but whether it is possessed by every part of it, or whether every part throws off the same quantity in a given time, has not been ascertained. It is, however, probable that some parts perspire more freely than others. The perspired matter passes off either in the form of a thin, invisible vapour, which is termed insensible perspiration, or in a liquid form, as sweat. Various attempts have been made to determine the quantity of the cuticular discharge*. From the time of Sanctorius, who first endeavoured to determine it experimentally, to that of Lavoisier and Seguin, little confidence could be placed in the results of the experiments, as the amount of the pulmonary exhalation was not deducted in calculating the loss which the body sustained in a given time. Much of this difficulty was overcome by Lavoisier and Seguin, by enclosing the body in a silk bag rendered impermeable to moisture by being varnished with caoutchouc, and having only one opening for breathing, the sides of which were carried round the

* The most extensive experiments on this subject were made by Mr. Jurine, of Geneva. (*Hist de la Soc. Roy. de Med.* vol. x.)

mouth. They ascertained that the medium quantity of moisture exhaled in the form of insensible perspiration amounts to nearly eighteen grains in the minute, or three pounds, three ounces, and a hundred and sixty grains, troy, in the twenty-four hours* ; and, as this was the result of repeated trials, we may regard it as the average quantity in a state of health. But an experiment of Mr. Cruickshanks renders it probable that some parts perspire more than others. Having enclosed his hand in a glass vessel, he collected thirty grains of fluid in an hour: now, as the hand is one sixty-sixth of the surface of the body, the perspiration, at this rate, should be nearly thirty-three grains in a minute, or six pounds one ounce and two hundred and sixty grains in twenty-four hours. The hand must, therefore, either perspire more than the rest of the body, or there must be an error in the experiment.

Many circumstances tend to vary the loss by perspiration, not only in different individuals, but in the same person at different times, and under a diversity of circumstances; as, for instance, the vigour of the frame, the nature and quantity of the ingesta, the temperature of the atmosphere, and many external relations. Thus, perspiration is diminished immediately after a meal, but augmented during the process of digestion: it is promoted during sleep; in a dry state of the atmosphere; in a current of air; and under a diminished barometrical pressure. But these circumstances are supposed to promote perspiration independently of vitality; and, therefore, Dr. Edwards has divided insensible perspiration into that which results from ordinary physical influence, and that which is dependent on vitality; or, into *exhalation* and *secretion*. Both are liable to be affected by external agents. In low temperatures, the loss by exhalation exceeds that by secretion, because the cold suppresses secretion much more than it impedes evaporation. It may, indeed, be maintained that, even in low temperatures, the cutaneous capillaries are still stimulated, and consequently that the portion of the insensible perspiration which is the result of vital

* Memoires de l'Academie des Sciences, 1790, p. 610.

energy must be supplied. It is in the ratio only of the stimulus which excites the vessels that furnish it; whilst that portion, the exhalation, which depends on physical influences, is less diminished, because the air, being heated by contact with the body, is enabled to hold more moisture in solution than the air farther removed from the body; and thence evaporation is favoured.

The evident intention of perspiration is to prevent the temperature of the body from rising above that degree which a state of health requires, and to operate as a balance to the heating influence of increased arterial action: it also counterbalances the secretions; as, for instance, that of the kidneys, which is diminished as the perspiration is increased, and augmented when it is checked—a physiological fact of much practical value.

Many experiments have been made to ascertain the chemical nature of the perspired fluid. It is supposed that its peculiar odour depends upon exhaled hydrogen gas, variously modified by the accession of other constituents*; for instance, oily matters, an acid, and gelatin. It appears, however, rather to depend on the secretions of the mucous follicles, which probably differ in different parts of the body, mingling with the perspiration, as the excretion or fluid which they secrete is different in different parts of the body. Thus, in the armpits the odour is hircine; in the feet it resembles that of tan; and in the genitals it is peculiar. This odour appears to be also, in some measure, connected with food and habit; for savages are able to distinguish the nation of persons by smelling them; and, if the details of history are to be credited, we must believe that the odour of the perspiration of Catherine de Medicis was as agreeable as that of the sweetest-scented flowers, and that of our countryman, Lord Herbert of Cherbury, was equally delightful. From all that is known on the subject, we may conclude that perspiration consists of two distinct kinds of matter—*aeriform* fluids, with

* Experiments on Insensible Perspiration, by W. Cruickshanks.—Hist. de la Société Royale de Medicine, tome ii; and also the experiments of Abernethy, in his Surgical and Physiological Essays.

bases of carbon*, hydrogen, and nitrogen†; and *aqueous* fluids containing in solution some free lactic acid, lactate, phosphate, muriate of soda, and an oleaginous principle; with scarcely a vestige of animal albumen.

Contemplating the nature of the perspiratory function, we may conclude that it is intended to answer two purposes—first, to convey caloric from the body, and thereby to moderate and regulate its temperature; secondly, to carry off a large quantity of carbon and hydrogen from the circulating mass. There is a marked distinction between plants and animals in the importance of this function. In plants, the exhalation from their surface is very great; in some plants, more than their own weight in twenty-four hours; the whole of the superfluous nutriment taken into their systems being thrown off by perspiration. In animals, although the skin is an outlet for much superfluous matter, yet the greater part is ejected from the body by the alimentary canal, the kidneys, and the lungs.

Disease is frequently the consequence of a sudden check to the perspiratory function; means, therefore, have been sought for to restore it; and the substances classed as Diaphoretics are supposed to have that power. Let us enquire in what manner they produce their effects.

Diaphoretics were originally regarded as solely stimulants, which were supposed to be absorbed; and those chiefly which operated by augmenting the vascular excitement were employed. It is reasonable to suppose that this would be the result of observing its natural excitement by exercise, and the application of external heat. Experience has rectified the fallacy of this opinion, and enabled us to reason upon the operation of Diaphoretics on sounder principles. They may operate in two ways: 1st, by stimulating generally, and so augmenting the force of the circulation as to propel the blood forcibly through the minute or capillary vessels of the *corium*, by which both the secreting power of the skin and the excreting

* Experiments of Count de Milly.—Histoire de l'Academie Royale des Sciences et Belles Lettres de Berlin, 1777, p. 35.

† Ingenhouz, Epériences sur les Végétanx, tome i, p. 152; Trousset, Annales de Chimie, tome xiv, p. 73.

function of the exhalants are increased; 2ndly, by the absorption of the diaphoretic substances taken into the stomach, and the direct application of these to the cutaneous capillaries. It is easy to conceive that, in the healthy state of the system, perspiration is always the result of stimulating, either directly or indirectly, the cutaneous exhalants; and sweating follows increased vascular action, whether this arise from muscular exertion or from substances taken into the stomach. But in disease, when the temperature of the body is augmented, and the pulse strong and frequent, indicating an increased excitement of the general circulation, the skin may remain dry. In this state there is evidently diminished action of the exhalants, whilst the cutaneous capillaries have their secreting power impeded by over-distention, from defective organic action and nervous energy; and, therefore, this condition must be overcome before diaphoresis can be produced. When the body is in a healthy state, and the cutaneous exhalants, consequently, are neither morbidly constricted nor the capillaries relaxed from want of nervous energy to maintain the current of the blood, sweating always follows increased vascular action. Those substances, therefore, which augment the force of the general circulation, whilst, at the same time, they relax the cutaneous exhalants are, undoubtedly, the most powerful Diaphoretics. Few substances produce this double effect alone; but it is readily induced by some combinations. Thus, opium increases at first the action of the heart and arteries; ipecacuanha, by the nausea it causes, diminishes the action of the surface; the combination of these two produces copious diaphoresis.

Those Diaphoretics which operate by augmenting the force of the vascular system increase the frequency and the power of the pulse, and raise the temperature of the body previous to the flow of perspiration: on the other hand, those which act by stimulating the cutaneous exhalants, without augmenting the force of the general circulation, exert a primary influence on the nervous energy of the stomach, and the skin responds by that inexplicable connection to which the term *sympathy* has been applied.

As the primary effect of Diaphoretics is the evacuation of

a large portion of the aqueous part of the blood, it might be supposed that this vital fluid would, in consequence, become thicker ; but various circumstances concur to prevent such a result: amongst others, thirst always accompanies sweating ; and as this forces us to take fluids into the stomach, the waste of the aqueous matter thrown off by the skin is rapidly supplied. At this time, also, other fluid excretions are diminished—the urine, for instance—so that the watery matters which would be carried off by them are diverted to the surface ; and even several substances, that naturally find other outlets, are expelled by the skin. This is clearly demonstrated in some diseases. Thus, in cases of ischuria renalis, or deficient action of the kidneys, the perspiration has been found to contain uric acid and other traces of urine. Dr. Percival relates a case in which the perspired matter was so saturated with the salts of the refluent urine as to crystallize on the surface of the body in the form of a white powder. Such a condition of circumstances is indeed not surprising, when we consider that the suppression of one secretion induces an unusual action in the vessels of some other organ and a changed condition of the secretion.

One unquestionable beneficial effect of Diaphoretics is the determination of the blood from the interior to the surface, thereby relieving congestions, and maintaining that due balance of the circulation which appears to be essential to the preservation of health. Their salutary effect is also displayed in the increased power of the capillaries, and in their relaxation of the surface in febrile affections.

The relaxing effect of Diaphoretics is indeed the most important property they possess as remedial agents, as it is upon this power that their utility in inflammatory affections depends. Were it, however, attempted to induce diaphoresis in inflammatory or febrile diseases by stimulating Diaphoretics, the desired effect would not only be prevented, but the hazardous symptoms would be aggravated. This fact is too seldom kept in view ; and, in ordering Diaphoretics in fevers, practitioners often forget that the substances employed as such almost always increase vascular action before they produce diaphoresis. Several circumstances, therefore, are

necessary to be attended to in the administration of this genus of medicines in a practical point of view.

1. Whenever Diaphoretics are indicated, the patient should be confined to bed, but not overloaded with bed-clothes, which also should be of a light, spongy texture. If the pulse be full, hard, and quick, and the skin hot, blood-letting, if not contraindicated from some peculiar circumstance, should preface the use of the Diaphoretics; and the bowels, also, should be freely opened. It is a correct opinion, that free perspiration is not consonant with a quick, hard pulse, and a temperature of the skin exceeding 102° of Fahrenheit: if sweating occur in this state, it is generally partial and rather injurious than salutary. Even after the reduction of the phlogistic diathesis, the Diaphoretics to be selected are those which nauseate and relax the surface.

2. The free use of diluents is necessary during the administration of Diaphoretics, unless the stomach be in a highly irritable state. If Antimonial Diaphoretics, however, be employed, acidulated drinks should not be given too soon after the dose of the antimonial, as vomiting would be induced. When the temperature of the surface is high, the diluents should be cold or nearly so; but when it is moderate, they should be tepid. So important is dilution in promoting the action of Diaphoretics, that even simple cold and tepid fluids introduced into the stomach during the hot stage of fever often produce diaphoresis.

3. During the administration of Diaphoretics it is essential to use bad conductors as coverings; both the body clothes and bed clothes of the patient should be flannel, which, being of a light, spongy texture, not only preserves an uniform temperature, but also absorbs the moisture as the perspiration flows. When a linen shirt is worn, and the patient lies in sheets, the moisture accumulates in them; for linen, being a better conductor of caloric than air, carries off the heat too rapidly and chills the surface. Attention to this circumstance is most essential, if it be requisite to keep up the sweating for ten or twelve hours, or longer; and especially if sleep become necessary during the continuance of the sweating. The older practitioners invariably resorted to the use of flan-

nel during diaphoresis—a custom which has been too hastily reprobated by sôme modern physicians, as not only unnecessary, but even injurious: they recommend, instead of flannel, frequent changes of well-aired linen, asserting that this is more refreshing to the patient; that, from its comfortable feel, it has a tendency to allay irritation, and, consequently, to aid in subduing the restlessness and inquietude of fever; and that it is essential for carrying off the fomes of the disease. The last part only of this opinion is well founded, and few practitioners would place a patient, labouring under an infectious fever, in flannel; indeed, under such circumstances, perspiration, to the extent which requires the use of flannel, is neither necessary nor desirable.

4. Attention must be paid to the state of the bowels and kidneys. If perspiration be necessary in the low stage of fever, purging must be studiously avoided, and should be checked if it occur spontaneously whilst sweat is flowing; as it is almost certain to check the sweating, and to aggravate the disease, by diverting the blood from the surface to the interior, and exposing the patient to cold. The utmost care, indeed, must be taken to prevent the admission of cold air to the surface; and no cold liquids should be taken into the stomach whilst the sweat is flowing, and for some time after it has ceased. This is not at all at variance with the opinion which I have already advanced, that sweating is excited by the introduction of cold water into the stomach in the hot stage of fever. During the administration of Diaphoretics, every thing which has a tendency to promote the secretion of the kidneys should be avoided. The avoiding frequent changes of linen is in conformity with this rule; as, in effecting these changes, the surface must be necessarily exposed, and, as much drink is generally given to promote the sweating, the redundant fluids will be suddenly determined to the kidneys, and the action of the cutaneous exhalants checked.

5. The morning, directly after sleep, is the best period of the day for administering Diaphoretics, as the system is then easily excited, and the surface is more relaxed. Experience has demonstrated that many persons, in whom perspiration cannot be induced at any other period of the day, may be

readily made to sweat at that time. When perspiration accompanies diseases, it generally occurs in the morning; there is then a natural decline of febrile excitement, which aids the action of Diaphoretics; and thence it is the most favourable time for their operation: and besides, as the administration of diluents is necessary to maintain the diaphoresis, this is a more convenient period for their administration.

6. When sweating is to be checked, the skin should be carefully dried with soft, warm towels, the patient should be moved into dry flannels, and the covering of his bed gradually lessened; allowing the arms to be cautiously exposed to the air. By these means the injurious consequences which a sudden revulsion might occasion are avoided.

Diaphoretics operate in two distinct modes:—the first set excite the cutaneous capillaries and exhalants to a degree sufficient to increase both the secretory and the excretory functions of the skin beyond that point at which the perspired matter is carried off in the insensible form: thence it appears as a copious watery excretion or sweat; and the substances inducing it are distinguished from other Diaphoretics by the term Sudorifics, or promoters of sweating. The second set operate in the same manner, but so moderately that they merely augment the ordinary insensible perspiration. It is true that both these results may be obtained by modifying the dose of the substances employed, and the circumstances under which they are administered; but, nevertheless, there are some substances, in which all circumstances being equal, produce a more powerful effect than others. For these reasons, Diaphoretics may be arranged into—

1. *Sudorifics*,—substances causing a copious, watery, cutaneous excretion, or flow of sweat.

2. *Diaphoretics*,—substances which only augment the ordinary perspiration.

Sweating may be produced by substances taken into the stomach, and by applications to the surface. It may also be induced by violent muscular action, throwing so much blood upon the surface as to excite powerfully the secreting function of the skin, and, consequently, greatly augment the perspiratory discharge. Exercise, therefore, may be regarded

as a remedial sudorific ; and it has been found of much use in dyspeptic affections, in which the skin is generally harsh and dry. It is easy to understand this effect of exercise ; for, if we admit that the function of digestion may become depraved by too large a quantity of blood being thrown upon the gastric vessels, the determination to the surface, which is the result of exercise, will necessarily relieve this morbid condition of the stomach.

TABLE OF DIAPHORETICS.

A. SUBSTANCES WHICH OPERATE AS SUDORIFICS.

1.—when taken into the stomach.

* *Organic Products.*

a.—EMETINA—procured from Cephaëlis *Ipecacuanha.*	5. 1.	Cinchonaceæ
b.—DAPHNINA—obtained from Daphne *Mezereum.*	8. 1.	Thymeleæ.
c.—CYTISSINA—contained in Arnica *montana.*	19 3.	Compositæ.
d.—MORPHIA—contained in Opium, Acetate of Morphia, Sulphate of Morphia, Muriate of Morphia.		
e.—GUAIACUM—proper juice of Guaiacum *officinale.*	10. 1.	Zygophylleæ.
f.—VOLATILE OILS—contained in		
Roots—Aristolochia *Serpentaria.*	20. 6.	Aristolochiæ.
Asclepias *gigantea.*	—. –.	Asclepiadeæ.
Wood—Laurus *Sassafras.*	9. 1.	Lauriniæ.
Leaves—Rhododendron *Crysanthum.*	10. 1.	Ericeæ.

** *Inorganic Substances.*

g.—ANTIMONIALS—

Antimonial powder.	*Pulvis Antimonialis.*
True James's powder.	——— *Jacobi vera.*
Precipitated Sulphuret of Antimony.	*Antimonii præcipitatum Sulphuretum.*
Tartrate of Antimony and Potassa.	*Antimonium Tartarizatum.*

2.—when applied to the surface.

h.—WARM AIR BATH.

i.—VAPOUR BATHS.

k.—WARM WATER BATHS.

3.—by violent muscular action.

B. SIMPLE DIAPHORETICS.

1.—which operate when taken into the stomach.

* *Organic Products.*

Animal.

a.—MUSK—a secretion of Moschus *Moschiferus*. 1. 8. Ruminantia.

Vegetable.

b.—SOLANIA—contained in Solanum *Dulcamara*. 5. 1. Solanaceæ.

c.—VOLATILE OIL—contained in

Roots—Dorstenia *Contrayerva*.	4. 1.	Monimieæ.
Herbs—Melissa *officinalis*.	14. 1.	Labiatæ.
Rorismarinus *officinalis*.	2. 1.	———

d.—CAMPHOR.

* * *Inorganic Substances.*

e.—SALTS—

Carbonate of Ammonia.	*Ammoniæ Carbonas.*
Citrate of Ammonia.	*Ammoniæ Citras.*
Acetate of Ammonia.	*Ammoniæ Acetas.*

f.—Water—

Cold Water.

Tepid Water.

g.—Empyreumatic Oil.

2.————by entering the circulation.

h.—Sulphur.

i.—Sulphuret of Potassa. *Potassæ Sulphuretum.*

k.—Mercurials.

3.————applied to the surface.

l.—Frictions.

m.—Cold Affusion.

ORGANIC SUBSTANCES WHICH OPERATE AS SUDORIFICS WHEN TAKEN INTO THE STOMACH.

a. Emetina. (Vol. ii, p. 208.)—This substance, separated from the Cephaëlis Ipecacuanha, has not yet been introduced into general practice in Great Britain, although it is much employed on the Continent. Ipecacuanha, in moderate doses, is well calculated to produce sudorific effects; but it is seldom administered alone for this purpose, being generally combined with opium, the narcotic influence of which it moderates. It forms the active ingredient of Dover's powder, the Pulvis Ipecacuanhæ compositus of the British Pharmacopœias. In the directions for forming this powder, equal parts of ipecacuanha root and opium are ordered to be rubbed together with eight parts of sulphate of potassa. The intention of the sulphate is to operate as a mechanical aid in reducing the tough opium to a fine powder, which is necessary to secure the efficacy of the compound.

In the original powder of Dr. Dover, four parts of nitre and four of sulphate of potassa were deflagrated together, and one part of opium, one of ipecacuanha, and one of liquorice root in powder were rubbed up with the residue. This

was an inconvenient preparation, as it attracted moisture from the air; it was therefore changed to the present more simple and efficacious compound. In this preparation, the diaphoretic influence of the ipecacuanha is augmented by the opium, whilst the soporific quality of that narcotic is greatly diminished by the ipecacuanha. The combined influence of both, exciting the cutaneous capillaries, produce a powerful and certain sudorific effect. It must, however, be kept in recollection that it is not the evacuation of fluid perspiration which is required, but the returning function of the skin to restore the balance of the circulation. It may be advantageously combined with camphor or with nitrate of potassa, but it ought not to be joined with astringent substances; the Emetina in these cases, combining with tannin, is rendered inert.

The dose of the compound powder of ipecacuanha is from gr. v to gr. x. Its sudorific effects, when once begun, should be maintained by copious dilution with tepid fluids; but tepid drink should never be taken immediately after the administration of the dose of the powder, otherwise it may be rejected by vomiting. It should also be remembered that the diluents should not be acidulated, as the combination of the vegetable acids with Emetina produce a compound, which is more likely to run off by the bowels than to exert a diaphoretic influence; at the same time it is advisable to add something to the tepid water to prevent the nausea being extended to vomiting. Lemon peel added to toast water answers well this purpose.

b. Daphnina.—This is the active principle of the bark of the Daphne *Mezereum*, a native of the north of Europe, belonging to the natural order Thymateæ. It is cultivated as an ornamental shrub in this country.

This principle is procured by digesting the bark in alcohol, filtering the tincture, and evaporating to dryness. The residue is then to be treated with water, and the filtered aqueous solution precipitated by the proto-acetate of lead. This precipitate is to be washed and diffused through water, and the lead separated from it by sulphuretted hydrogen gas; the fluid is then to be filtered and evaporated to dryness: the residue of this evaporation being redissolved in strong

alcohol without the aid of heat, and the filtered solution left to spontaneous evaporation, the Daphnina crystallizes, and pure crystals are obtained by washing with cold alcohol, re-dissolving, and crystallizing.

Daphnina thus prepared is in prisms connected in bundles, colourless, transparent and brilliant, and very soluble in hot water. The warm aqueous solution deposites crystals on cooling: these are very soluble in alcohol and ether. The alkalies, lime water, and barytic water tinge the solution of a golden yellow colour; it is not precipitated by the acetate of lead. Nitric acid converts Daphnina into oxalic acid. From these experiments, it is evident that Daphnina is a principle sui generis; but whether the medicinal properties of Mezereum are to be attributed to this substance is not yet decided.

The bark of Mezereon yields its virtues to water and also to vinegar. Different chemists have analyzed various parts of this plant. M. C. G. Gmelin and M. Roer found, in the bark, wax, an acrid resin, the peculiar principle common to the bark of all the species of Daphne, which has been described *Daphnina;* a red colouring matter; an uncrystallizable and fermentable sugar; an azotized gum; ligneous fibre, a brown colouring matter, malic acid, malates of lime, of magnesia, and of potassa. But, besides these, the bark of Mezereon contains a volatile matter insoluble in water; and which, not being found in the decoction, is supposed to be the cause that the acrimony of the bark is much greater than that of the decoction. When this decoction is precipitated by the sub-acetate of lead, a portion of Daphnina is thrown down with the gum.

As a remedial agent, Mezereon operates as a stimulant Diaphoretic, exciting powerfully the heart and arteries, and determining to the surface; but it is apt to cause vomiting and purging. It has been found useful in rheumatism and in some chronic cutaneous diseases. It was long supposed to be a remedy for syphilis; but, according to Mr. Pearson's experience, it has no power of curing the venereal disease; and, "I have," says he, "very seldom found it possessed of medicinal virtue, either in syphilis or in the sequelæ of that

disease, in scrophula, or in cutaneous affections." Now, my experience enables me to say that this censure is too severe. I admit that the value of the remedy has been greatly overrated; but that it operates powerfully as a stimulant sudorific is equally certain; and I have seen the decoction administered with much advantage in chronic rheumatism, and in conjunction with the arsenical solution in obstinate cases of lepra vulgaris. Even Mr. Pearson, in opposition to his general censure, admits that he has seen it confer temporary benefit in lepra. The decoction, made with ʒii of the bark to ℔ii of water, is given in doses of f℥iv three times a day. How far the addition of Mezereon to the compound decoction of sarsaparilla is useful, I am not prepared to say from my own experience; although this combination is regarded by authors as extremely beneficial in secondary syphilis and many chronic diseases.

c. CYTISSINA.—This substance, which is the active principle of Arnica *montana*, was discovered by MM. Chevallier and Lassaigne*. It is of a yellow colour; its taste is bitter and nauseous, and it is inodorous. Exposed to the air, it attracts moisture, thence is very soluble in water; but it is scarcely dissolved by strong alcohol, and not at all by ether. Its aqueous solution displays neither an acid nor an alkaline reaction, and is not precipitated by any of the metallic salts used in medicine. In doses of three grains, it operates as an emetic; and in smaller doses, as a diaphoretic.

Arnica *montana*, of which Cytissina is the active principle, is a native of the Alps and Pyrenées, and the north of Europe. It belongs to the natural order Compositæ.

The flowers of Arnica have a slight aromatic odour, a bitter acrid taste, and impress a sensation of pungency and heat to the throat. The powder operates as a sternutatory when snuffed up the nostrils.

The infusion of Arnica *montana* contains gallic acid, a resin which has the odour of the plant, gum, albumen, some salts, and Cytissina. The flowers of Arnica are the officinal parts of the plant. They may be administered in powder, in doses of six to eight grains, or in an infusion, made with two

* Journ. de Pharm. June, 1819.

drachms of the flowers to one pint of water, of which f℥i may be given for a dose. An etherial tincture of Arnica is employed on the Continent.

Arnica, besides exerting a decided influence on the skin, through the medium of the stomach, operates especially on the spinal nerves, and also on the brain. An hour after taking a full dose of the powder or the infusion, the patient is attacked with vertigo, cephalalgia, a sensation of formication on the surface, heats, rigors, and twitchings in the extremities. In large doses, it causes vomiting and gripings. The circulation is also affected, the pulse is quickened, the temperature of the body is elevated; sweat flows freely, or, when this does not occur, the excretion of urine is greatly augmented. From these effects, it is evident that Arnica is a medicine of considerable power. It is a warm, stimulating sudorific, and is much employed in Germany in intermittents, low fevers, chronic rheumatism, and gangrene; but it is rarely employed in this country. It has been also used as a stimulant in various forms of paralysis, more especially that of the bladder*.

d. MORPHIA. (Vol. i, p. 511.)—Morphia and all its salts, particularly the *Acetate*, *Sulphate*, and *Muriate*, operate as sudorifics, and greatly augment the power of other sudorifics with which they may be combined. They are never prescribed alone, but generally in combination with ipecacuanha or antimonials. They operate chiefly by their excitant influence, and therefore are given in small doses. Much, however, depends on the state of the habit: when the skin is very sensible, these salts readily promote sweating; but in the opposite condition of the skin their influence is scarcely perceptible. It is evident that they are likely to prove beneficial in all diseases which require the aid of copious diaphoresis; and, in the combinations in which they are usually prescribed, their narcotic influence is scarcely perceptible. Morphia, in its simple state, is so insoluble that it is never employed: the above-mentioned salts may be given in doses of gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$, repeated once in three or four hours. They are contraindicated in hectic.

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* Ann. de Med. tome iii.

e. GUAIACUM. *Guaiacum.* L. E. D.—This substance, which, for a long time, was improperly regarded as a resin, is the concrete juice of a tree, the Guaiacum *officinale*, a native of the West Indies and the tropical regions of America, belonging to the natural order Zygophylleæ. Both the wood and the guaiacum are brought to Europe for medicinal use. The wood, which is called lignum vitæ, from its durable nature, exhales, when heated, an aromatic odour, and when chewed impresses a bitter, acrid, biting taste on the palate—qualities which it affords to water when rasped and boiled with it. The Guaiacum is obtained by boring the junks of the wood longitudinally, and putting one end of them in the fire, so that as the heat increases the Guaiacum exudes from the opposite end. When in a soft state, the Guaiacum is run into boxes and thus sent to Europe, on which account these packages contain it of every quality.

Guaiacum is in masses of a greenish-brown colour, breaking with a shining, vitreous fracture ; the edges of the fragments are thin and translucent : it softens in the mouth, melts in a greater heat, and loses its green colour, which, however, it again acquires on exposure to light and air. It is inodorous when in the mass; but when powdered or melted, it exhales an aromatic odour. Its taste resembles that of the wood, leaving a sensation of heat in the throat when it is swallowed.

Guaiacum is only partially soluble in boiling water ; and, when filtered, affords a decoction of a green colour, which shews the presence of a salt of lime when tested with oxalate of ammonia. Alcohol readily dissolves 95 parts in 100 of Guaiacum, and offers some curious results when submitted to the action of different substances. Thus, many recent vegetable substances—horse-raddish, the potatoe, and many other roots, if sliced and dipped into the tincture—receive a colour on all the open orifices of the sap vessels, which renders them visible. Milk, when agitated with it, also acquires a blue colour. If water be poured into the tincture, it is instantly precipitated of a white colour, as if it were a resin. Sulphuric acid, even in small quantity, precipitates the Tincture, as does also the muriatic. Chlorine changes it to a beautiful

blue ; and with nitric acid the Tincture passes successively to green, blue, and brown ; even a piece of paper, soaked in it and held over the vapour of nitric acid, is tinged blue. A blue precipitate is said to be also produced by the hydrocyanic acid and the distilled water of the bitter almond ; but this is erroneous. A blue colour is communicated by sweet spirit of nitre, if recent, owing to its containing some uncombined nitrous acid ; but when it has been kept long enough to assimilate this, no colour is produced. The pure alkalies do not precipitate the Tincture ; a fact of practical utility in prescriptions.

Muriatic acid produces little action on Guaiacum ; sulphuric acid, aided by gentle heat, carbonizes it ; and sulphate of lime is found in the charcoal of the residue. Nitric acid is partially decomposed by it more rapidly than by the resins, and the oxygenized Guaiacum is dissolved in the remaining acid, from which it is precipitated in its altered state by muriatic acid. The sulphuric produces no precipitate. Crystals of oxalic acid are formed in the nitric solution when it is left at rest for some hours.

When submitted to destructive distillation, Mr. Brande procured from a thousand grains of Guaiacum, 5.5 grains of acid water ; 24.5 of a brown turbid oil ; 30 of light empyreumatic oil ; 30.5 of charcoal ; and the remainder gases, consisting of carbonic acid and carburetted hydrogen. These results, and the effects of acids and the reagents on the Tincture of Guaiacum, are sufficient to shew that it is a substance sui generis ; and widely different from resin and gum-resin.

Guaiacum was employed as a remedy for syphilis so early as 1508, from observing that it was used for the same purpose by the natives of St. Domingo. But in St. Domingo the fresh and young wood was employed for making the decoction. A curious account is given of the mode of employing it by M. Louis, in his work entitled " Parallele des Treatemens, &c." Two young men, Frenchmen of rank, who could not obtain a cure of a severe syphilitic affection in Europe, went to St. Domingo. They were treated in the hut of a native at Puerto Rico. The practitioner was a female. She bruised and cut with her teeth, the small branches of a

young Guaiacum tree, and boiled them in an open vessel. The patients drank two pints of this decoction every morning, at two or three draughts; then they were ordered to walk out, or to exercise themselves with fencing, or else they worked in a gold mine, not far from the village, for two hours; then returning home, covered with sweat, they changed their shirts, dined, and drank only water. About three o'clock in the afternoon they drank the same quantity of the decoction of the fresh Guaiacum wood, and performed the same exercises. They were perfectly cured in six weeks, without any inconvenience, except a swelling and inflammation of the gums. The nodes in their bones disappeared; their nocturnal pains left them in fifteen days; and, after returning home, they remained permanently well.

The decoction of the wood has been given in this country to the extent of a quart a day in secondary syphilis; but although it has been found to be a useful auxiliary in removing some of the symptoms attending this stage of the complaint—such, for instance, as ulceration of the tonsils and incipient nodes—yet Mr. Pearson, who is high authority upon this subject, remarks, "in no instance has the powers of this medicine eradicated the venereal virus." It does not appear, however, that the same violent exercises have been pursued during its administration as in St. Domingo.

From its action on the skin, the Decoction of Guaiacum has proved serviceable in impetigo, and some other cutaneous affections—for instance, in that ulceration of the nostrils which is termed Ozaena, and in scrophulous states of the membranes and ligaments. It appears to be useful in these cases from its stimulant properties, and its determination to the surface. In chronic rheumatism, attended with cold extremities, the Tincture of Guaiacum, made with ammonia, has been used. When arterial action has been subdued, and this tincture is given in large doses, of from f℥ss to f℥ii, at bed time, and its operation as a sudorific aided in the morning with copious dilution, in a tepid state, it seldom fails of affording relief to all the symptoms. As long as it produces only a slight or partial warmth of the body, the dose of the Tincture may be increased, even to f℥iv: but if it purge

much at this dose, it should be decreased, unless the purging be accompanied with warm sweating—a thing not likely to happen. In cases of atonic gout, in which the pains wander from joint to joint, it is also prescribed with advantage: but the boasted efficacy with which its introduction as a gout medicine was proclaimed, has not been realized. Dr. Chapman, an American Professor of Materia Medica, writes thus:—"There is a morbid affection of the eye, of a gastric origin, hitherto not sufficiently noticed, where, although no external inflammation exists, or so slightly as hardly to be perceived, there is great intolerance of light, sometimes very acute lancinating pains through the ball; though, more generally, the sensation is that of a dull, obtuse ache, attended with much heat and aridity of surface, which, whatever may be its nature, is very successfully treated by the Guaiacum." He appeals to his own experience of the efficacy of this medicine, and affirms that he never saw the disease cured by any other. It is given in the form of the ammoniated tincture, in doses of f℥i three or four times a day. I have never seen the disease described by Professor Chapman; but it is probably connected with a scrophulous diathesis, in which case this remedy may prove useful. In administering either the decoction of the wood or the Tincture of Guaiacum, the patient must be kept in bed, if we expect to produce its sudorific effects; as, otherwise, instead of producing diaphoresis, it will excite the urinary discharge.

To promote diaphoresis, Guaiacum may be given in substance, in doses of gr. x to ʒss, made into a bolus, or it may be combined with water, by means of mucilage of gum. The Decoction of the wood is a very inert preparation; and the Tincture, when given with aqueous vehicles, should be rubbed up with mucilage to suspend the precipitate. Dr. Paris recommends a solution to be made by rubbing equal parts of quicklime and Guaiacum together, and allowing it to settle. This solution mixes with aqueous matters without decomposition. The dose of the Tincture is from f℥i to f℥iii.

f. VOLATILE OILS.

These are in a state of combination in various plants: they are too stimulant to be employed as Sudorifics, except in diseases of a diminished excitement.

1. SERPENTARIA ROOT. *Serpenteriæ Radix.* L. E. D. (Vol. i, p. 191.)—When the skin is hot and dry, and requires the employment of a Sudorific, and yet the nauseating and relaxing Diaphoretics cannot be employed, the Serpentaria is one of the best of the stimulant Sudorifics; its activity depends on volatile oil and resin; and on that account the form of tincture is preferable to that of infusion. It has been found useful in dyspeptic affections, accompanied with a dry skin; and forms an excellent addition to the Cinchona bark, or the salts of Quinia, in protracted cases of intermittents, and in atonic gout. The dose of the Tincture of the Pharmacopœias is from fʒss to ʒii in any light, bitter infusion or decoction.

2. MUDAR. *Asclepiadis giganteæ Radicis Cortex.*—The species of Asclepias yielding this bark is a native of Bengal, belonging, as its name implies, to the natural order Asclepiadeæ. The root, which is the active part, is long, branching, woody, and covered with thick lactescent bark. In preparing it for medicinal use, it is dug up in April and May, well washed, and allowed to dry in the air, so as to inspissate the proper juice. The cuticle is then scraped, and the root decorticated and dried: in this state, it is of a dull, whitish-fawn colour, smooth on one surface, and slightly corruscated on the other; its taste is rank and nauseous; its odour not unlike that of pease meal.

The Mudar has been long employed by the native practitioners of India, in syphilis*, lepra, elephantiasis, rheumatism, and many other diseases. It is a powerful stimulant sudorific, exciting the cutaneous capillaries, and diminishing velocity of the general circulation. Its influence on the glandular system is also well ascertained: in many respects it resembles

* Mr. Twining, of the Bengal Medical Service, affirms "that it has an especial power of promoting the exfoliation of diseased bones."

that of mercury. It proves most beneficial in low states of the habit, indicated by pallidness, emaciation, disordered digestion, and imperfect assimilation: in the opposite condition of the body, it proves decidedly injurious. During its use, the diet should be mild and vegetable; wine and every stimulant being carefully avoided. In large doses, it produces much constitutional disturbance, especially on the brain and nervous system, and nausea.

This bark may be given in the form of powder, in doses of gr. iii to gr. x, repeated every second or third hour. In doses exceeding ten grains, it operates on the kidneys. In India, the native doctors apply it externally as a suppurative.

3. SASSAFRAS. *Sassafras-lignum et Radix.* L. E. D. (Vol. i, p. 199.)—Sassafras is a stimulant Sudorific when the surface of the body is kept warm during its administration. Experience has confirmed its efficacy in gout and rheumatism. If Sassafras, in full doses, do not produce sweating, it produces febrile excitement; and this generally occurs in plethoric persons of a dry, bilious temperament. The influence of this Diaphoretic on the cutaneous capillaries has suggested its employment in skin diseases; but when these are of an inflammatory description, it ought not to be prescribed. It is usually taken in the form of infusion, made with half an ounce of the chips and two pints of water. On account of the volatile oil, which is undoubtedly its active principle, decoction is a bad form of preparation.

Sassafras is now rarely employed, except as an ingredient in the compound decoction of Sarsaparilla. The oil, as an oleo-saccharum, would be a more certain method of communicating its influence in general: it might be given in doses of from m. iii to m. vi.

4. THE LEAVES OF RHODODENDRON. *Rhododendri Crysanthi folia.* L. E. D. (vol. i, p. 590.)—The leaves of the Golden-flowered Rhododendron, although highly prized as a sudorific in Russia, where it is indigenous, has disappointed the hopes of practitioners in this country.

In Siberia, a weak infusion of these leaves is used daily as tea: in a stronger decoction it produces effects not unlike those of intoxication; and has consequently been called *In-*

toxicating Tea in Russia. To produce its diaphoretic effect, the Siberians infuse ʒii in f℥xii of boiling water, for a night, in a warm place. The whole of this infusion is taken in the morning upon an empty stomach: it soon nauseates, and excites perspiration; and, while this continues, food is proscribed. After some hours, it generally produces a copious, black, fœtid stool; and, if the disease be rheumatism, the patient rises free from pain. Dr. Halliday, of Moscow, in a letter to Dr. Paris, says that the severest fits of gout are cured by repeating the medicine for three successive days. In large doses, besides nausea, it causes vomiting, delirium, and all the other symptoms of intoxication; and, when these subside, a proportional diminution of excitement takes place.

The Rhododendron Crysanthum has been brought to this country and submitted to trials, both in gout and rheumatism; but it has totally disappointed the hopes of those who have prescribed it. Whether this is owing to the plant suffering from drying or from climate, or owing to the constitution of the patients being different, I will not pretend to determine. The plant, therefore, although retained in the list of Materia Medica of the Edinburgh College, yet is never prescribed in this country.

* * *Inorganic Substances.*

g. ANTIMONIAL PREPARATIONS.

1. Pulvis Antimonialis. *Antimonial Powder.* L. E. D. —This powder is a compound of oxide of antimony, antimonious acid, and phosphate of lime. According to the London and Dublin Pharmacopœias, it is formed by burning together one part of sulphuret of antimony and two parts of shavings of hartshorn: the Edinburgh College orders equal parts. When brought to a white heat, the sulphur is completely expelled, and the oxide, gradually absorbing oxygen, partly passes into antimonious acid. It is the latter substance which gives the yellow colour to the preparation when it is strongly heated. It is an inodorous, insipid, dull white powder, insoluble in water and scarcely soluble in acids.

The utmost diversity of opinion exists respecting the utility of this preparation, many practitioners contending that it is perfectly inert, others asserting "that it is one of the best Antimonials which we possess*." From the results of its administration in my own practice, I cannot place any confidence in its diaphoretic powers. If there be much muriatic acid present in the stomach, it may prove active; but in general it displays no influence whatever on the system. It has been given in doses of sixty, eighty, and one hundred and thirty grains, without any sensible effect. Its occasional activity may be ascribed to the oxide being accidentally in the state of a protoxide.

2. JAMES'S POWDER. *Pulvis Jacobi vera.* The celebrity of the powder of Dr. James, as a certain diaphoretic, has led to many unsuccessful attempts to imitate it: and the antimonial powder of the Pharmacopœias was intended as a substitute for this empirical remedy. According to the analysis of James's powder by the late Dr. Pearson, 100 grains contain 57 grains of peroxide of antimony and 43 of phosphate of lime: according to the analysis of Mr. Phillips, the proportions are 56 grains of the peroxide and 44 of the phosphate. But were these analyses correct, this powder would prove as inert as its imitation; for the peroxide of antimony produces no effect on the living system. I have satisfied myself that James's powder contains a protoxide of antimony, to which its diaphoretic influence may be justly ascribed; and I am confirmed in this opinion by the analysis of Signor Pully, an Italian chemist. According to him, James's powder consists of 7 parts of protoxide of antimony, + 4 of phosphate of lime, + 3.5 of potassa intimately combined with protoxide of antimony. The dose is gr. v to gr. x.

3. PRECIPITATED SULPHURET OF ANTIMONY. *Antimonii præcipitatum Sulphuretum.* L. E. BROWN ANTIMONIATED SULPHUR. *Sulphur Antimoniatum fuscum.* D. (Vol. ii, p, 353).—The dose of this preparation as a diaphoretic has been much understated. It may be given to the extent of gr. x, in combination with calomel and opium: but it

* London Med. Gazette, December, 1831.

is uncertain in its operation; and, therefore, is seldom employed, except as an ingredient in the compound calomel pill of the London Pharmacopœia.

4. Tartrate of Antimony and Potassa. *Antimonium Tartarizatum.* L. E. D. (Vol. ii, p. 223.)—This is one of the most certain of the antimonial diaphoretics. In doses of one sixth to one fourth of a grain, in combination with calomel and opium, frequently repeated, it rarely fails to produce copious diaphoresis. This effect might, indeed, be anticipated from the greater solubility of tartar emetic than any of the other antimonials. Next to this is James's powder: all the others are uncertain in their effects.

No medicines are so much modified in their effects by idiosyncracy as antimonials: in one person, small doses of tartar emetic will induce only moderate sweating; in another, the same dose will cause alarming vomiting and purging, extreme depression, both of bodily strength and mental energy, or excite a degree of nausea which cannot be allayed.

The influence of antimonials is much augmented by combination with calomel, camphor, opium, and many other substances; but, in prescribing tartar emetic, it should be recollected that it is decomposed by the alkaline carbonates, the medicinal soluble salts of zinc, lead, bismuth, and mercury; and that an insoluble tannate is formed with the protoxide of the tartrate, when it is added to the astringent vegetable infusions and decoctions, with the exception of those of oak bark. The tannate thus formed is inert; on which account the decoction of yellow Chincona bark is the antidote of tartar emetic when it is over-dosed.

In acute rheumatism, in which my experience has led me to discard bleeding, unless the patient be of a very strong, sanguine temperament, I know nothing that proves more serviceable than a combination of one grain of calomel, a quarter of a grain of emetic tartar, and from one grain to two grains of opium. Some authors recommend the Tartrate of Antimony and Potassa to be compounded with prepared chalk: but this preparation is apt to run off by the bowels instead of causing diaphoresis. Upon the whole, when the intention is to de-

termine to the surface, the Tartrate of Antimony and Potassa, given in simple doses, frequently administered, is more manageable than any other of this class of remedial agents.

When tartar-emetic is given in large doses, it subdues inflammatory action without inducing nausea or vomiting after the first or second dose, or even exciting diaphoresis. As this mode of employing tartar-emetic has excited much attention, some account of it may not be deemed unprofitable. If three, four, or six grains of this salt, dissolved in a glassful of water, be taken for a dose, one or two vomitings and one or two alvine evacuations follow; but if the same quantity be repeated two or three hours afterwards, neither vomiting nor purging will ensue; nor will they occur even if the dose be augmented to half a drachm or more, and its use continued for several successive days: under these circumstances, no other inconvenience except thirst is experienced. There are, nevertheless, exceptions to this rule; and, occasionally, inflammation and ulceration of the pharynx, œsophagus, and stomach, supervene. The pulse is lowered in a remarkable manner, and reduced in frequency: and sometimes the most copious sweating is induced. The administration of large doses of tartar-emetic was suggested by Dr. Rassori, an Italian physician, who also taught that inflammation operates as a protecting power against the influence of tartar-emetic, and that the degree of morbid excitement may even be determined by the extent to which the doses can be carried with impunity. The utility of this mode of administering tartar-emetic in restraining inflammatory action is undoubted; but the diaphoretic influence of the medicine is most certainly secured when it is given in small doses, frequently administered.

2. SUBSTANCES WHICH OPERATE AS DIAPHORETICS WHEN APPLIED TO THE SURFACE.

h. BATHS.

The stimulant influence of caloric upon the living habit is well ascertained: it operates powerfully upon the cutaneous exhalants, and causes diaphoresis in whatever manner it is

applied, within certain limits. As I formerly stated, it may be applied through three media—*air*, *aqueous vapour*, and *water*.

1. WARM AIR BATH.—This bath consists of air, the temperature of which is artificially raised above that of the body in a state of health. Warm air chambers were used as luxuries by the ancient Romans; and in Russia, and some other parts, they are still employed previous to the use of the vapour bath. As a medicinal agent, the Warm Air Bath was employed by the older physicians*. In warm climates, the skin is almost always bathed in perspiration; and, for medicinal purposes, it is not necessary to elevate the temperature of the air much above the temperature of the climate in order to obtain a decided diaphoretic effect. In air at 150°, a sensation of smarting is experienced in some parts of the body, especially the eyes and nose, and, in females, in the nipples; the general surface feels pungently hot; the superficial veins are dilated; the urine is lessened in quantity; and, after a short time, a copious sweat breaks out over the whole body. If the latter effect do not take place, the pulse beats strongly, increases in rapidity, sometimes beating 160 in a minute, and headache and vertigo supervene. In this form, the warm air chamber is rarely employed as a diaphoretic; but, more frequently, warm air is partially applied to excite perspiration.

The *Sudatorium* or partial hot air bath was suggested by the late Dr. Gower†, in 1819, when physician to the Middlesex Hospital. His apparatus consisted of a wicker, oblong arch, which was placed over the patient, and covered with blankets. At the end of this frame, and under the covering, was placed a lamp, over which rose a kind of chimney or tube, which conveyed the air heated by the lamp to the space surrounding the patient: all the subsequent inventions of air baths are merely modifications of Dr. Gower's apparatus. At a temperature of 85°, air applied in this manner causes profuse sweating; it is stimulating to the surface, and has not a very soothing effect on the nervous system; but it is more certainly productive of sweating than either the warm water bath or the vapour bath. It has been found serviceable in

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* Hoffmani Opera Omnia, t. i, p. 465.

† Auxiliaries to Medicine, 8vo. London.

chronic rheumatism, and other painful affections of the joints; in rigidities of the limbs; and in psoriasis and some other scaly eruptions. In congestive fevers, in which the powers of the habit are unequal to restore the balance of the circulation—indicated by a cold, clammy state of the skin; a feeble pulse; the breathing hurried; the countenance anxious and livid; and the whole corporeal energies oppressed—the Warm Air Bath is productive of the most salutary effects. It is peculiarly indicated in the state of collapse attending Indian cholera: but, in many of the cases in which it was used, in that disease, the temperature was elevated to a degree which, in the depressed state of the vital powers, was productive of the most injurious, and, in some instances, fatal consequences. The Warm Air Bath, therefore, has undeservedly fallen into neglect.

Various vapours, such as sulphurous acid, chlorine gas, and the vapour of iodine, have been added to the Warm Air Bath; but its diaphoretic powers are not augmented by these additions; and it is generally necessary to throw in watery vapour after the application of these gases and medicinal vapours, which altogether alters the character of the bath.

2. WARM WATER BATH.

Under this name are comprehended two varieties of water baths.

a. The Tepid Bath.
b. The Warm Bath.

a. THE TEPID BATH, *Balneum tepidum,* — consists of water of a temperature from 86° to 92°. At 86° water scarcely feels warm, and certainly exerts no stimulant influence on the skin, and is rather to be regarded as a refrigerant than a diaphoretic; at 92° the warmth is agreeable, and the effects on the habit are soothing. It is useful in dry and irritable conditions of the skin, accompanying febrile affections; and many individuals, from idiosyncracy, who cannot tolerate the warm bath, derive much advantage from the employment of the Tepid Bath. In such persons it excites diaphoresis; but, in general, this is not the result of its employment. It has

been found most salutary in convalescence from acute diseases, when brisk exercise is taken after it.

b. THE WARM BATH. *Balneum calidum mitius.*—The temperature of this bath is between 92° and 98° Faht. It is applicable to almost every purpose for which warm-bathing is indicated, with the exception of a few cases which demand the use of the hot bath. Its excitant powers on the cutaneous capillaries is sufficient to cause perspiration, whilst, at the same time, they sooth the nervous and vascular systems. It may be said rather to solicit than to drive the blood to the surface: it allays irritation, relaxes spasm, relieves pain, and displays a secondary sedative influence, whilst its primary effect is stimulant and directly diaphoretic.

The Warm-water Bath was employed for medicinal purposes, and indulged in as a luxury in the earliest ages of society.

As an article of luxury, we read of the use of the hot, or warm bath, in the book of Genesis ; in the works of Herodotus and Xenophon, and in those of all writers who have transmitted accounts of the customs of the Asiatic nations. In the Odyssey we find that it was used by the Greeks at a very early period of their history. It is probable that they received it from the Egyptians; and it is undoubted that the Greeks transmitted it to the Romans. With that luxurious people the use of hot baths was carried to the highest pitch. The elegant and stately Gibbon thus describes the baths of Caracalla and Diocletian. " The stupendous aqueducts, so justly celebrated by the praises of Augustus himself, replenished the *Thermæ*, or baths, which had been constructed in every part of the city with imperial magnificence. The baths of Antoninus Caracalla, which were open at stated hours, for the indiscriminate service of the senators and people, contained above sixteen hundred seats of marble; and more than three thousand were reckoned in the baths of Diocletian. The walls of the lofty apartments were covered with curious mosaics, that imitated the art of the pencil in the elegance of design and the variety of colours. The Egyptian granite was beautifully incrusted with the precious green marble of Numidia; the perpetual stream of hot water was poured into

the capacious basins through so many wide mouths of bright and massy silver; and the meanest Roman could purchase, with a small copper coin, the daily enjoyment of a scene of pomp and luxury which might excite the envy of the kings of Asia. From these stately palaces issued a swarm of dirty and ragged plebeians, without shoes and without a mantle; who loitered away whole days in the street or Forum, to hear news and to hold disputes; who dissipated, in extravagant gaming, the miserable pittance of their wives and children; and spent the hours of the night in obscure taverns and brothels, in the indulgence of gross and vulgar sensuality*." The ruins of the baths of Severus, Domitian, and Constantine, which still remain amid the fractured monuments of the Eternal City, sufficiently attest the truth of this description. Some of those baths which I have mentioned cover several acres of ground, and exhibit, in their fragments, the most exquisite specimens of Grecian architecture.

It is pleasing to the mind to dwell upon these subjects; to reflect on the manners and times which are no more; to linger amidst the ruins of past magnificence, and muse upon the fractured column and the fallen dome; to trace the writing nearly effaced upon the walls; and, whilst silence and desolation brood upon the scene, to compare the customs which prevailed a thousand years ago with those of the passing hour. But the fascination of such enquiries must not seduce us from our humbler but more useful investigations.

In curing diseases, the warm Bath has also been employed from the earliest times. We might mention those which are natural, whether consisting of pure water, or water holding various saline matters in solution: but the history of these thermal springs would occupy more space than we can spare for such enquiries; I shall therefore confine myself to the consideration of the artificial warm Bath.

The effect of heated water upon the living body differs according to its temperature.

We have already examined the effects of the hot bath, which is purely stimulant (vol. i, p. 321), and therefore can

* Gibbon's Decline and Fall of the Roman Empire, vol. v, p. 282.

be employed only in particular cases. The first effect of the Warm-water Bath is on the nervous system; the fluid impresses an agreeable and soothing feeling to the skin, uneasy and irritable sensations are abated, and a tranquil and pleasing languor steals upon the senses. According to the degree of temperature, the action of the heart and arteries is increased; but, after a time, the pulse softens and perspiration breaks out. The ultimate effect is the relaxation of the surface—a result of the warm bath, which seems to depend on the combined influence of the caloric and the water; for it is produced by neither alone.

In examining the effects of the warm Bath, they appear to operate on two principles:—1. They act upon the body nearly in the same manner as upon other masses of matter: 2. They operate upon it, as it is endowed with vitality. The second mode of operating is that which chiefly interests us. Looking at the warm Bath in this point of view, we find that it stimulates gently the sensibility of the body. The influence of heated water, as an excitant, is felt before its diaphoretic effects are displayed, and in the direct ratio of the temperature employed. In the warm Bath, at 98°, the sensation is ageeeable; it is almost intolerable in the hot bath at 106. This appears, at first view, inexplicable, when we reflect upon the high temperature which the body can bear in hot air: and we are inclined to enquire why the sensation of heat is so much greater when caloric is introduced by the medium of water? Various circumstances contribute to produce this effect:—in the bath the surface does not exhale, which is a cooling process; and the aërial perspired matter probably forms a warm atmosphere around the body.

Besides the sensibility, the warm bath affects also the irritability of the system: the pulse is quickened, but not much; it is also fuller than before; but after a short time this effect is modified by the condition of the body. In health, the pulse is at first moderately accelerated; but, according to the series of experiments made by Marker in a bath between 87° and and 97°, the morbid velocity of the pulse in fever is diminished; in both cases it becomes slower in proportion to the length of time the person remains in the bath. This effect

also varies in different persons. Now, although the ultimate effect of the warm Bath be the reduction of the velocity of the pulse, yet, in general, its first impression is to increase it. The warm Bath, indeed, in this respect agrees with all other stimulants: it first excites, and ultimately produces a state the opposite of excitement. Nor are these effects different, with the exception of the degree in the hot bath between 98° and 104°: in the hot bath at 104°, the velocity of the pulse is increased after the patient has been twenty minutes in the bath; the arteries beat violently to the ends of the fingers, even after immersion for half an hour: the breathing becomes laborious, the vessels acquire turgidity, and the surface is red; but, after three quarters of an hour, sweat bursts forth; and, in fifteen minutes after coming out of the bath, the pulse and the heat become natural, and much languor is experienced.

The effects of the warm and hot Baths differ in this respect —the former is relaxant and sudorific, the latter stimulant and sudorific. In the warm Bath, the diminished tension of the skin diminishes the tension of the whole frame; thence, the phlogistic diathesis is relieved, and the sudorific effect of the hot bath depends on its powerful stimulant properties: thence the warm Bath is better calculated to stimulate the capillaries to that extent which favours diaphoresis than the hot Bath; its salutary effect is the result of its derivative, relaxant, and diaphoretic powers.

As a therapeutical agent, our attention in the present instance must be confined to its diaphoretic influence. In acute inflammatory affections, the warm Bath is always serviceable, provided blood be previously abstracted; and this is especially necessary when the inflammation is accompanied with pain and spasm. In chronic inflammations, the same prefatory measure is demanded; but as, in these, the determination of blood is usually confined to some particular organ, local bleeding is preferable to general bleeding previously to the use of the warm bath. The irritable state of the stomach and mucous membrane of the alimentary canal, the dry and unhealthy condition of the skin, and the cold extremities, strongly indicate the employment of the warm Bath in dyspeptic affections. Besides equallizing the circula-

tion, its influence on the nervous system tranquillizes the hypochondriacal feelings always attendant on dyspepsia: it is always a safe, generally a most salutary remedy; and to these effects we may ascribe the advantages which follow its employment in the intervals of gout and rheumatism, in conjunction with friction and percussion.

In febrile affections, the warm Bath is found to prove beneficial in the cold stage of intermittents, chiefly on account of its derivative influence; and it is still more useful when there is much nervous irritation present. But some caution is required in plethoric states of the habit: this condition should always be removed by the employment of the lancet before resorting to the use of the warm bath.

Several rules and cautions are requisite to be observed in the employment of the warm bath; but as these refer equally to the vapour bath, they need not be noticed until we have examined the properties of the latter.

3. The Vapour Bath. *Balneum Vaporis.*

When, instead of air, aqueous vapour is employed as the vehicle of caloric, the effects are somewhat different from those arising either from the air bath or the warm-water bath: a much higher temperature can be borne in air than in aqueous vapour, and a much higher in vapour than in water.

In Russia, the Vapour Baths are steam chambers or stoves; they are fitted with benches rising above one another; and the vapour is produced by throwing water on stones heated to redness by a furnace underneath. The vapour at the bottom of the room is 112°, at the top it is 180°. The bathers sit at first on the lower benches, and gradually ascend to the higher. (Vol. i, p. 320.) It is not easy to explain the power of sustaining so high a temperature in the Vapour Bath; probably, as the evaporation from the surface is continued and the cooling process carried on whilst no evaporation takes place in the water bath, is the reason why so high a degree of temperature can be supported in these baths. The relaxation induced by this Vapour Bath is greater than that experienced in the water bath. How is this explained? Were the human body a mass of inanimate matter, there could be

no difficulty in offering a satisfactory theory of this effect; for we know that vapour penetrates matter and softens it more than water of an equal temperature; but this reasoning cannot be applied to explain its relaxant influence on the living body. Something is undoubtedly due to the degree of stimulus, the first effect of which is to cause contraction instead of relaxation: now, when vapour of a high temperature is employed, the degree of stimulus is less than that produced by the water of the same temperature, whilst the relaxant property is equal; and, therefore, as the relaxant power is not counteracted by an opposing influence, the necessary consequence is the increase of effect. When vapour is used, also, it is applied to the interior of the thorax, at least to the air tubes as well as to the surface of the body; and something may be thus effected by a greater extension of surface.

The Vapour Bath employed in this country is of a more limited character; in general, the head is not enclosed in the bath, so that the patient does not breathe the warm vapour, although he may do so at his pleasure. The simplest form of Vapour Bath is that employed by the Hindoos (vol. i, p. 319). Vapour at 106° to 120°, if not breathed, is equal in its influence on the body to water at 98°; but when the vapour is breathed, 110° is equivalent to the highest degree of the warm-water bath, namely 98°. At these temperatures, the Vapour Bath is a more powerful derivative than the warm-water bath, and consequently it is more certainly diaphoretic; whilst, at the same time, it is less soothing and tranquillizing. This form of bath is peculiarly serviceable in the early stage of catarrhal affections, especially if the vapour be breathed, so as to be applied to the mucous membrane. The temperature should not exceed 106°; indeed, in every case, if the perspiration can be obtained at a low temperature, the more is it likely to prove salutary.

Notwithstanding the apparent simplicity of the application of the warm bath, there is no remedy so frequently abused: thence the necessity for rules to regulate its use; and these are applicable to every form of the Bath, whether air, vapour, or water be employed.

1. In persons of plethoric, apoplectic, or hæmorrhagic

habits, or where there exists organic disease of the heart, the utmost caution is requisite in the employment of the warm bath, unless previous depletion has been resorted to; and, even after this, the temperature of the Bath should not exceed 96°, and its equivalents if air or vapour be used. Equal precaution is necessary during the presence of the catamenia and during the latter months of pregnancy. Warm bathing is altogether contraindicated in great debility and relaxation of the system, and even when the nature of the disease indicates its utility; yet, if the individual case afford an instance of any of those conditions to which we have just referred as requiring caution, the nature of the attack does not alter the necessity for caution in its employment.

2. When the use of the Bath is determined upon, the degree of temperature must be regulated by the particular nature of the case, and the condition of the patient. If diaphoresis be our object, the heat of the Bath should not exceed 98°; but many persons find a lower temperature more agreeable and soothing; and this predilection should not be counteracted. The temperature of the Bath should be sustained at the same degree as long as the patient remains in it. The time for remaining in the Bath must be determined by circumstances: if much relaxation be desirable, the time should be considerable; and, if the disease be of a chronic character, or if it be cutaneous, the period may be extended to two or more hours. In acute diseases, the bath must be employed at the time in which its influence is required: in chronic diseases, however, when much diaphoresis is required, it should be used in the evening, and the patient should sleep in blankets; but when this is not the object, it may be taken in the forenoon, about two hours after breakfast; so that the patient may exercise himself in the open air after it, between the time of using it and dinner; although an unnecessary exposure to the open air, if the weather be cold or damp, must be avoided.

At whatever time of the day the Bath is used, it should not be too often repeated, except in cases of spasm and severe pain, in which its relaxant and anodyne, rather than its diaphoretic, influence is required.

In delicate habits, a warm sea or salt-water Bath is prefer-

able to one of simple warm water, not only because it is less relaxing and there is less risk from exposure after its use, but because it is more derivative, and the stimulant influence of the saline matter on the skin continues after coming out of the bath. The nature of the saline impregnation modifies the action of the bath; thence, the various thermal springs differ in their effects, and sea water differs from all of them.

In employing the warm Bath as a Diaphoretic, friction should always be used in the Bath; and diluents with flannel clothing when the patient is taken out of it. Among the ancients, the bathers were anointed with oil and other unguents on emerging from the Bath; and thus, by preventing too copious perspiration, the body was slowly cooled. Indeed, in all the ancient authors who mention baths, we find that the *Unguentarius* was the principal officer attached to the Bath; and in this respect we should do well to imitate our forefathers.

3. DIAPHORESIS FROM VIOLENT MUSCULAR ACTION.

Violent exercise produces that vascular action which is the exciting cause of positive sweating under states of the body unaccompanied by a morbid constriction of the cutaneous exhalants. It can scarcely, however, be regarded as a therapeutical agent; but it is wrong to assert that muscular action has never been employed as a remedy; for, although it has not been prescribed by the physician, yet it has been employed frequently by the vulgar, and with decided advantage. I have seen the paroxysm of an ague shortened by bringing on the perspiratory stage by running, immediately the cold fit was felt to be approaching; and I have more than once seen acute rheumatism cured by taking a long and fatiguing walk. It is true that this remedy, in either disease, can be employed only by the man of determination and courage, whose energy of mind rises superior to his corporeal sufferings. In the one case, namely, the paroxysm of ague, the sensation of indolence and weariness, and the bruised feeling which is extended over the whole body, with the confusion of ideas and the irksomeness of the attempt to bend the atten-

tion, for any time, to one object, unnerves even the strongest man and unfits him for exertion; whilst, in the other, acute rheumatism, the sense of pain appears almost to be sufficient to prevent walking even in the stoutest-hearted individuals; yet persons occasionally appear who are capable of overcoming these difficulties, and have found their advantage in the boldness of their resolution.

In one disease, however, to which humanity in all its pride is humbled—Insanity—exercise, in the manner necessary to produce a sudorific effect, is often successfully employed as a remedy. In this case it performs what powerful stimulants effect in some other diseases: it diffuses the blood over the system, and tends to restore that balance of the circulation which is always disturbed in this greatest of maladies.

B. SIMPLE DIAPHORETICS.

1. SUBSTANCES WHICH AUGMENT THE ORDINARY PERSPIRATORY FUNCTION WHEN TAKEN INTO THE STOMACH.

* *Organic Products.*

Animal.

a. Musk. *Moschus.* L. E. D.—The nature of this animal secretion has been already fully described (vol. i, p. 609). Its diaphoretic powers are feeble; and, therefore, it is rarely prescribed as a Diaphoretic in this country.

Vegetable.

b. Solania. This is the active principle of the Solanum *Dulcamara*, a plant very common in our hedge rows, flowering in June and July*. It belongs to the natural order Solanaceæ.

Solania is a white, inodorous, opaque powder, of a slightly bitter taste, and displaying the characters of an alkaloid. It is insoluble in cold water, and requires eight thousand times its weight of hot water for its solution; but it is soluble in

* Woodville's Med. Bot. 3rd edit. p. 240, pl. 85. London Dispensatory, art. Solanum.

alcohol, in ether, and acids. With acids it unites and forms neutral salts, which have a bitter taste. It is procured by precipitating a strong decoction of bitter-sweet with ammonia, collecting the precipitate, drying it, and treating it with boiling alcohol. This menstruum takes up the Solania and deposites it on cooling*. In bitter-sweet it is combined with malic acid.

Solania has not yet been employed in medicine, but Dulcamara is in common use as a Diaphoretic. The decoction of the twigs of dulcamara, collected in autumn, has been advantageously given in lepra and some other cutaneous diseases, in conjunction with arsenic, and sometimes with bichloride of mercury. The dose of the decoction, made with ℥i of the bruised twigs and a pint and a half of water boiled down to a pint, is from f℥i to f℥ii, administered three times a day. It frequently excites nausea at first; and on this, probably, the diaphoretic powers of the plant, in some degree, depend. If its use be continued for some time, the strength of the decoction should be gradually augmented. It precipitates sulphate of iron, nitrate of silver, and acetate of lead, which, therefore, cannot be prescribed with it; but it produces no effect on the bichloride of mercury, nor on tartar-emetic, lime water, nor the alkalies.

Although the decoction excite nausea and vomiting, it can scarcely be regarded as capable of acting as a poison. In very large doses, it operates as a narcotic, causing vertigo, dilatation of the pupils, slow and intermittent pulse, and trembling of the limbs; but no instance of death from its influence is recorded. The best antidote is the subcarbonate of potassa.

Dulcamara has been chiefly used in cutaneous diseases.

c. VOLATILE OIL.

From the well-known excitant influence of Volatile Oil, its diaphoretic powers might be anticipated. It is never given uncombined to produce sweating, and the substances in which it exists are now seldom employed.

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* Journ. de Pharm. tome vi, p. 374, and tome vii, p. 414.

1. CONTRAJERVA ROOT. *Radix Contrajervæ.* L. E.—The Dorstenia *Contrajerva** is a native of Peru, Mexico, and the West Indies, belonging to the natural order Monimieæ. The root, which is the part employed, consists of an ovoid, tapering body, compact, rugose, and furnished with numerous fibres. It is externally of a brownish colour, internally whitish. The odour of the dried root is peculiar, somewhat aromatic, and the taste warm, bitterish, and astringent. On account of its mucilaginous character, mixture, infusion, or decoction, is a bad form of preparation: it is generally administered in the form of powder, in doses of gr. v to ʒi; and, on the Continent, an alcoholic tincture of the root is employed; but it has the inconvenience of being decomposed by water.

Contrajerva is a stimulant Diaphoretic of little power. Owing to its influence in retarding the progress of putrefaction in dead animal matter, it has been employed in low states of fever; but, I need scarcely remark, with little advantage. In combination with the carbonate of lime of prepared shells, it has been found useful in the dentition of weakly infants; where there is much acidity of the stomach, and the tone of the habit requires to be supported.

The remaining Diaphoretics, which owe their efficacy to combined Volatile Oil, namely, Balm, Melissa *officinalis*, and Rosemary, Rosmarinus *officinalis*, are seldom employed, except as domestic medicines, and might be rejected from the list of Diaphoretics.

d. CAMPHOR. *Camphora.* L. E. D.—Experience has clearly ascertained that Camphor influences the cutaneous capillaries and produces a tendency to diaphoresis; and this without increasing the velocity of the pulse. Camphor, however, except as a fumigation, is seldom employed alone as a Diaphoretic; in combination with antimonials and opium, it insures the action of these substances on the skin. As a fumigation (vol. i, p. 234), its diaphoretic influence is undoubted; and, among the substances usually added to the warm-air bath, nothing proves more serviceable than Camphor.

* Woodville's Med. Bot. 3rd edit. p. 705, plᵗ 240. London Dispensatory, art. Dorstenia.

** *Inorganic Substances.*

f. SALTS.

1. CARBONATE OF AMMONIA. *Ammoniæ Carbonas.* L. E. D.—This salt (vol. i, p. 400) operates through the nervous system, and produces diaphoresis when aided by external warmth and plentiful, tepid dilution. It is highly probable that, in producing this effect, the Ammonia is taken into the circulation, and immediately applied to the superficial capillaries—an opinion which is supported by the well-known fact, that the liniment of Ammonia, applied to the neck as a counterirritant in inflammation of the tonsils, is invariably followed by copious perspiration, provided the patient be kept warm. Carbonate of Ammonia is indicated as a Diaphoretic in the sinking stage of typhoid fevers, and other diseased conditions in which, notwithstanding the presence of much debility, diaphoresis is still desired; but otherwise its place can be much better supplied by many other substances. In combination with guaiacum and opium, considerable advantage has been obtained from it in obstinate cases of chronic rheumatism; and, in such cases, its internal administration is much aided by its external application in combination with camphor. To produce its diaphoretic effects, the dose of Carbonate of Ammonia should not be less than twelve, nor more than twenty grains. In larger doses it causes vomiting. The best vehicle for administering it is the almond emulsion.

2. CITRATE OF AMMONIA. *Ammoniæ Citras.*—This salt, which is generally prepared at the moment of its administration, by saturating recent lemon-juice, or a solution of citric acid, with carbonate of ammonia, possesses very moderate diaphoretic powers. It is seldom obtained crystallized, and does not crystallize until its solution be evaporated, without heat, to the consistency of a thick syrup, when it shoots into long prisms. Its taste is cooling and moderately saline. It is very soluble in water; and is so easily decomposed, that the Ammonia is separated by the application of a moderate heat. According to the analysis of Vauquelin, it consists of citric acid 62, + ammonia 38, in 100 parts.

For medicinal purposes, this neutral salt has long been

known, as an extemporaneous preparation, under the name of *Saline Mixture.* It is usually prepared with recent lemon juice, the principal constituent of which is citric acid: fifteen grains of the carbonate of ammonia are sufficient to neutralize half a fluid ounce of fresh lemon juice. It possesses less diaphoretic power than the solution of acetate of ammonia; but it is not so nauseous, and consequently it is more generally used as a vehicle for other Diaphoretics—as, for instance, antimonials and opium; but, for this purpose, it is requisite to render the solution perfectly neutral. The same remarks apply to the citrate of potassa, which is equally efficacious as a Diaphoretic, and more generally employed than the Citrate of Ammonia. It consists of citric acid 55, + potassa 45, = 100.

It is also usually prepared at the moment of administering it; and, when given in a state of effervescence, is well adapted for allaying nausea. A scruple of the carbonate of potassa, dissolved in water, is added to half an ounce of lemon juice, diluted with mint or any distilled water. Some practitioners still recommend the old method of taking the saline draught, namely, first swallowing the solution of the alkali, and immediately afterwards the lemon-juice, so as to extricate the whole of the carbonic acid in the stomach. This method has its advantages; the alkaline solution allays the irritability of the stomach, whilst the. distention of the viscus by the carbonic acid, which is thus closely applied to its nerves, affords a certain degree of tone, without interfering with the diaphoretic operation of the neutral salt, formed during the union of its two bases. The more common method, however, is to give it during the act of effervescence, by mixing the acid and the alkali before the mixture is swallowed.

3. SOLUTION OF ACETATE OF AMMONIA. *Liquor Ammoniæ Acetatis.* L. E. D.—Acetate of Ammonia is seldom administered in the solid form. In solution, or as the old Spiritus Mendereri, it is very frequently employed. To prepare it, the acetic acid contained in distilled vinegar is saturated with carbonate of ammonia: the carbonic acid flies off in the gaseous form, and the acetate, produced by the union of the acetic acid and the Ammonia, remains in solution. The va-

riable strength of distilled vinegar, and the careless manner of preparing this solution, render it seldom of the same strength—a circumstance, however, of little moment as far as regards its diaphoretic powers, but of some consequence in prescribing it in conjunction with many substances. A strictly neutral solution, which should be ascertained by means of litmus and turmeric paper, is requisite. When the alkali predominates, the solution of tartar-emetic, occasionally prescribed with it, is decomposed; when the vinegar is in excess, the usual dose of the antimonial excites vomiting. The excess of the carbonate of ammonia, also, renders this preparation injurious as a collyrium.

This solution, as a Diaphoretic, or as a cooling lotion, or collyrium, is decomposed by many substances which might be inadvertently ordered in conjunction with it. Decomposition occurs with alum and lime water, but no precipitate is thrown down when the solution is strictly neutral: with bichloride of mercury a precipitate takes place; and when the alkali predominates, the acetate of lead, also, is thrown down, which, however, is owing to the carbonic acid of the excess of carbonate of ammonia forming an insoluble carbonate of lead. On this account, it is of great importance to have a perfectly neutral solution when it is administered, even in a diluted state, to wash down pills with the acetate of lead. The acetate of lead is not hurtful; but the carbonate is extremely deleterious, bringing on colica pictonum, and paralyzing the entire intestinal canal. The addition of magnesia to this solution extricates ammoniacal gas; which is owing to the magnesia forming a triple salt, an Acetate of Ammonia and magnesia, and consequently setting at liberty a portion of the Ammonia.

Were this salt easily procured in the solid form, the solution would always be of a uniform strength; but its volatility prevents its crystallization from being readily effected. It may, however, be procured by careful evaporation, or by throwing streams of gaseous ammonia and of acetic acid into the same receiver, kept cool. If strong acetic acid be used for making the solution, and this be evaporated by a gentle heat, it crystallizes in needle-form crystals. By a slow sub-

limation, M. Lassone obtained long, slender, flatted crystals, terminating in sharp points, of a pearl-white colour. This salt impresses the tongue with a sensation of coldness; and then of sweetness, mixed with a mawkish taste. It is very deliquescent. The constituents of neutral Acetate of Ammonia, as far as can be ascertained, are—acetic acid 75, + Ammonia 25, in 100 parts.

The ordinary Solution of Acetate of Ammonia is an excellent Diaphoretic when aided by keeping the surface warm, and by tepid dilution: it lowers the pulse, and abates febrile heat; thence it is well adapted for cases of inflammatory fevers, and all diseases of excitement. When perfectly neutral, so that antimonials may be combined with it, without suffering decomposition, it is an admirable vehicle for administering antimonials and opium, greatly aiding the effect of both on the skin. The usual dose is from ʒiv to fʒxiii, which may be given in any bland fluid. It is easily retained on the stomach, and often allays the irritability of that organ.

g. WATER. *Aqua*.—This diaphoretic agent requires to be examined in two distinct states:—

a. Cold Water.
b. Warm Water.

a. Cold Water implies that the temperature of the fluid does not exceed 65° Faht. Water at this temperature, when taken into the stomach, promotes the function of the skin, and favours diaphoresis. The greater part of the matter of perspiration consists of water; and if the skin be kept warm, so as to check the action of the kidneys, the quantity of perspiration is generally the ratio of the quantity of fluid taken into the stomach. But, besides this cause of the diaphoretic influence of water, it is also well known that the sudden impression of a draught of cold water upon the nerves of the stomach acts most forcibly in promoting diaphoresis. This effect of Cold Water is well known to men of intemperate habits, who, on retiring to bed in a state of intoxication, and awakening in the night, with a dry, feverish, parched tongue, a quick pulse, and a hot skin, find immediate relief by swallowing a large draught of Cold Water:

the cutaneous capillaries immediately consent with the stomach, and copious perspiration quickly ensues. By imitating this practice in fevers, a similar result is obtained. When Cold Water is to be employed as a sudorific, much of the effect produced depends on the management of the patient during its administration. If the surface be kept warm, and the body be surrounded with non-conductors, a small quantity of water will produce the effect required. Under these circumstances Cold Water is more effectual than Warm, although the latter is more generally employed than Cold Water. The ancients, according to Celsus, cured fevers in this manner.

b. Warm Water.—The production of a sudden reduction of heat, in delicate frames of body, even in fever, when the excitement is high, is hazardous; and, therefore, warm or tepid diluents are employed to effect the same result as cold water. In general, when tepid fluids are administered to excite sweating in continued fever, the quantity of water swallowed must be large; the surface ought to be kept warm, and small quantities of saline or aromatic matters should be combined with the tepid drink.

Besides being diaphoretic itself, water, both cold and hot, is the general auxiliary of all other Diaphoretics; nor can their influence upon the skin be maintained for a sufficient length of time without ample dilution. When the fluid is intended rather to keep up than to provoke perspiration, it should be either tepid or warm. When the first is the object in view, the temperature of the water or the aqueous fluid should be at least 65°; when the object is to provoke sweating, the temperature should be about 100°, and the quantity considerable. The same rules, indeed, are necessary for regulating the administration of diluents, as for the external employment of water. When the temperature of the body is under 94° in disease, cold drink should not be administered: in fevers, therefore, when it is indicated, the temperature of the patient should be ascertained: he should remain in bed, in flannels, and the fluid be administered in small quantities, frequently repeated.

Upon the whole, the advantages of water as a sudorific,

and for aiding in maintaining the sudorific effect of other Diaphoretics, is sufficiently obvious: the pure state is the best for obtaining its diluent effects. Nature points out the indication for our guide, both as to its administration at first and the continuance of it, in the sensation of thirst which accompanies every state of febrile action on which diluents and Diaphoretics are required. Where this sensation is present, we cannot err in administering water; the temperature of the body and the state of the skin determining whether it shall be cold or warm.

h. EMPYREUMATIC OIL.

The only oil of this kind which has been employed as a Diaphoretic is that of the liver of the Cod fish. It has been prescribed in chronic rheumatism: but in the only case in which I ever ordered it, severe nausea and vomiting supervened: indeed, I am inclined to believe that few stomachs are able to bear it with impunity.

2. SIMPLE DIAPHORETIC SUBSTANCES WHICH ENTER THE CIRCULATION.

i. SULPHUR. L. E. D. — This simple substance, when taken into the stomach, passes into the circulation, and, augmenting the natural perspiration, is carried off through the cutaneous exhalants united with hydrogen—a fact demonstrated by silver, worn in pockets of those taking it, becoming blackened in the same manner as if it had been exposed to a stream of sulphuretted hydrogen gas; and, as it thus passes off, it excites diaphoresis. As a Diaphoretic, Sulphur is prescribed in cases of chronic rheumatism, and some other skin diseases; and, in combination with oil, under the form of oleum sulphuretum, in chronic catarrh: but this is an acrid, nauseous preparation, and, consequently, is seldom administered. It is a simple solution of Sulphur in fixed oil; but, when heated, a decomposition of this oil takes place, and sulphuretted hydrogen gas is evolved. When properly prepared, it has a reddish-brown colour, a fœtid odour, an acrid taste, and a viscid consistence. The dose is from m. v to f℥ss, in any bland vehicle. The dose of Sulphur, to produce its diapho-

retic effects, should not exceed half a drachm. Modern practitioners, however, have properly disregarded the preparations of this medicine as far as its diaphoretic properties are concerned.

k. SULPHURET OF POTASSA. *Potassæ Sulphuretum.* L. E. D.—In combination with potassium, sulphur forms a solid and a fluid preparation, hepar sulphuris and hydrosulphuret of Potassa; both of which are diaphoretic. The solid Sulphuret, Hepar Sulphuris, when recently prepared, is a liver-coloured substance; but it soon becomes green by the action of the oxygen of the air. It is hard, brittle, and breaks with a vitreous fracture; its taste is bitter, acrid, and caustic; and it leaves a brown stain on the skin. In making this preparation, the direction of the London College should not be explicitly followed; but the subcarbonate should be first exposed to a red heat in a crucible, before it is mixed with the sulphur. In melting the ingredients together, the Potassa, which is an oxide of potassium, is decomposed, the oxygen, uniting with a portion of the sulphur, forms sulphuric acid, which combines with a part of the Potassa and produces a Sulphate; whilst the remainder of the sulphur attaches itself to the uncombined potassium and forms a Sulphuret. This preparation, therefore, is a compound of Sulphuret of Potassium and of Sulphate of Potassa. When dry, the solid Sulphuret has scarcely any odour; but, when moistened, it exhales the smell of sulphuretted hydrogen gas, owing to the decomposition of the water, and the union of its oxygen with one part of the sulphur and its hydrogen with another: the consequence of which is the formation of Sulphate of Potassa, and Hydroguretted Sulphuret of Potassa. That is to say, the sulphuric acid formed, unites with a portion of the Potassa, and forms an additional quantity of Sulphate of Potassa, whilst the sulphuretted hydrogen combines with the Sulphuret of Potassium.

The liquid Sulphuret, or hydroguretted Sulphuret of Potassa, is a liquid of a reddish-brown colour. When newly prepared, it has not much odour; but by keeping it acquires a very fœtid smell; it feels soapy between the fingers, and stains the cuticle a greenish-black. The acids and the me-

tallic salts decompose it, and the latter are converted into sulphurets. It ought to be preserved in well-stopped bottles, as it rapidly attracts oxygen from the atmosphere, is decomposed, and the greater part converted into sulphate of potassa. On this account it is employed, in eudiometrical experiments, to ascertain the proportion of oxygen contained in any given portion of air. Neither sulphuric, nitric, nor muriatic acid can be prescribed, even when largely diluted with these preparations. If sulphuric acid be added, a precipitate of sulphur and sulphate of potassa takes place ; when muriatic acid is added, the precipitate is sulphur in the state of a hydrate.

Both these preparations have been employed as Diaphoretics in chronic asthma and chronic catarrh, and in several cutaneous affections ; and, in combination with conium, in cancer, at least as a palliative. The chief use of this preparation, however, is as an external application.

l. MERCURIALS.

Mercurials, in whatever form, when introduced into the habit, are excreted by the skin, provided they do not pass off by the bowels ; and this is particularly the case when the doses are small. This action of the salts of Mercury upon the capillary system has been long known ; and, in having the cuticular discharge promoted by them, it is probable that the skin only shares as a secreting organ in the general influence which they exert on the glandular system.

As the Mercury in these salts exhales from the skin, in a metallic or reduced state—at least we draw this conclusion from observing the effect of it upon gold and silver worn in the pockets of those under a course of Mercury—we cannot be certain whether this reduction takes place at the surface, and consequently by what means the exhalants and cutaneous vessels are actually stimulated. All the preparations of Mercury, which exert a decided influence on the habit, are either oxides or chlorides, in which state they are taken into the circulation. How long they continue unaltered after being admitted into the blood it is impossible to say ; but the probability is that some change takes place in the glandular

system, upon which undoubtedly they exert their stimulant influence. In promoting the cuticular discharge, therefore, Mercury seems to operate as a general stimulant to the glandular system, in which of course the skin shares as a secreting organ; and, if we can draw a correct conclusion from the consequences, we are authorized to say that the mercurial oxides and chlorides employed, undergoing decomposition, give out oxygen or chlorine, which are their active principle, and, indeed, the actual stimulants to the secreting system. Be this as it may, the effect of mercurial preparations upon the cuticular discharge is demonstrated by daily experience; but, nevertheless, Mercurials are not administered as direct Diaphoretics, but merely as powerful auxiliaries in promoting the influence of other Diaphoretics, particularly the preparations of antimony and opium.

A query may be advanced, whether the action of Mercurials is confined to the capillary system? In reply, it must be admitted that Mercurials stimulate generally the vascular system; that the action of the heart and arteries is increased during a mercurial course, when the preparation is given in such a manner as to prevent it from operating as a purgative; but it is equally true that the peculiar effect of Mercury cannot be ascribed to its general stimulant influence; some specific action takes place upon the glandular and capillary systems, independent of the general increased force of the circulation; and it is to this that we are to ascribe its effects as a Diaphoretic.

Calomel, the *Submuriate*, or, more correctly speaking, the *Proto-chloride of Mercury*, is the preparation usually selected for obtaining the action of Mercury on the skin. In prescribing it in combination with other Diaphoretics, it should be known that if ammonia, which is a Diaphoretic, be ordered in combination with calomel, the latter is decomposed, the protoxide or black oxide is formed, and chloride of ammonia remains in the solution. In the same manner the sulphuret of potassa and the hydro-sulphuret are Diaphoretics; and both decompose calomel and convert it into the proto-sulphuret or black sulphuret. In both cases, the activity of the medicine is greatly impaired by the change which takes

place; and the dose of Calomel, which otherwise would be amply sufficient to produce its diaphoretic effect, becomes, by this decomposition, utterly inadequate for that purpose. Sulphuret of antimony also decomposes Calomel.

Calomel is scarcely ever exhibited alone, with the view of obtaining its diaphoretic effect. When combined with tartar emetic, James's powder, guaiacum, opium, or ipecacuanha, it imparts certainty to the sudorific powers of these substances. In these combinations, it is given with advantage in all inflammatory affections, in cutaneous eruptions, and in chronic rheumatism. As a Diaphoretic, the dose of Calomel is one grain.

3. SIMPLE DIAPHORETICS WHICH OPERATE WHEN APPLIED TO THE SURFACE.

Whether sweating or mere diaphoresis be produced, the cause of the perspiration, as far as the substances we have already examined are concerned, is the increased action of the whole vascular system; but, as far as relates to the few remedial agents under this head, the increased excitement is wholly confined to the cutaneous vessels.

m. FRICTIONS.

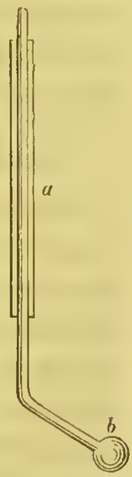
These operate upon the cutaneous vessels directly, and may be considered as equivalent to muscular exertion in producing sweating.

n. THE COLD AFFUSION.

With regard to this agent, there may be some objections to the place which it holds, on a hasty consideration of the theory of its operation: but although its effects are general, although febrile excitement and general arterial action are diminished, in accordance to that law of the system which informs us that by diminishing tension in one part we diminish it in the whole, yet is the application truly local.

When cold water is dashed upon the body, labouring under a state of febrile excitement, its effects are a diminution of the heat of the skin, and the force and frequency of the pulse,

diaphoresis, and sleep. These effects are not solely the result of the sedative influence of cold; for although this be great, and the abstraction of caloric is sufficient to reduce at once the temperature of the body from 106° to 94°, yet this alone would not produce that diaphoretic effect on which much of the advantage derived from the cold affusion depends; we must, therefore, look out for another cause, and we find it in the sudden and powerful shock which this mode of applying cold water gives to the whole system, and the salutary reaction which ensues. The use of the cold affusion as a Diaphoretic is indicated when the skin is hot and dry, the tongue parched, the face flushed, accompanied with headache and pulsating at the temples, restlessness, and watching. Perhaps it is less adapted to the fevers of our temperate climate than to those of tropical regions, when the general excitement is at its greatest height. It is of much importance, however, to ascertain that no visceral inflammation exists, that the catamenia are not present, and that the patient is not in the latter months of pregnancy, as, in such conditions of the habit, dangerous effects might follow the employment of so powerful a remedy. Even when no circumstance of the kind just mentioned contraindicate the use of the cold affusion, still the following precautions are necessary to be always kept in view.



1. The *temperature of the body* should be accurately ascertained by introducing the bulb, *b*, of a small curved thermometer, *a*, under the tongue, with the lips closed upon the instrument, or within the axilla. If the heat be under 96°, the cold affusion should not be applied; neither can it be used if perspiration be already present, even though the heat of the body at the moment be much greater than usual. Dr. Currie remarked that, under these circumstances, the application of cold water is accompanied by a diminution of temperature, and a deficiency of reaction, which are at least hazardous.

2. *When a sense of chilliness* is present, although the thermometer indicate a morbid degree of heat, the cold affusion

is dangerous; suspending respiration, producing a feeble, frequent, and irregular pulse, and sudden collapse which threatens, if it be not always followed by, extinction of life.

3. When fever is advanced, the temperature of the water should not be more than 15° or 20° below that of the body.

4. The patient, immediately after the use of the cold affusion, should be placed in bed, and some warm wine and water administered, to encourage the reaction, which is the object of the remedy.

Before applying the cold affusion, the hair of the patient should be removed; he should be stripped naked, and, being seated in a tub, four or five gallons of water, at 40 to 60°, should be thrown over him; and this should be repeated two or three times, or until a rigor come on; after which he should be immediately removed to bed. The period of the evening exacerbation of fever, which in general occurs from six to nine o'clock, is perhaps the best time for using the affusion; but it may be advantageously employed at any time of the day, if the symptoms indicate the propriety of such a step. It is sometimes of advantage to add salt to the water; and Dr. Currie was of opinion, that by this addition the affusion is not only more grateful to the feelings of the patients, but that it may be used for a length of time with much less hazard than when plain water is employed.

The diaphoresis which follows should be maintained by free dilution with tepid fluids, as if it had been induced by any other of the means which have been described.

THERAPEUTICAL EMPLOYMENT OF DIAPHORETICS.

Direct Diaphoretics, in augmenting the action of the cutaneous capillaries, are well adapted for relieving internal congestions; diminishing febrile excitement, and, by the cooling influence of evaporation, reducing the morbid temperature of the body. They were very early employed in the cure of diseases: indeed, the common observations of men, in the most uninformed state of society, must have taught them that, when the body is labouring under febrile excitement, this immediately ceases if a sweat breaks out. It was natural, therefore, that means should have been sought for to

promote this state, rather than to trust to it as a natural crisis: thence in the treatment of diseases, sweating is a prevalent and popular remedy. On this account, however, the employment of Diaphoretics has been often abused—a charge not exclusively confined to the unprofessional.

The diseases in which Diaphoretics are decidedly indicated are fevers; but, as these vary in their characters, so also the mode of using Diaphoretics must vary. In intermittent fevers, they have been administered in three ways—1. immediately before the cold stage, to prevent the accession of the paroxysm: 2. during the paroxysm, with the intention of bringing it to a speedy termination: and, 3. during the interval, to promote the natural perspiration, and to aid the return to health.

1. The cold stage is the first of the succession of symptoms which constitute the paroxysm of intermittents: it may be removed by exciting an opposite state; and accordingly we find that, when sweating can be induced about the commencement of this stage, the paroxysm is either lessened in violence, or it is shortened in duration, or altogether prevented. Now, how is sweating, in this case, to be effected? but, first, let us enquire how it has hitherto been produced.

Among rude nations, the simplest means for warming the body artificially are resorted to: the Negroes in Jamaica, for instance, Dr. John Hunter informs us, stretch themselves out in the sun; whilst other equally rude tribes endeavour to diffuse the blood and throw it upon the surface by exercise, and therefore run vigorously as soon as they feel the least indication of the approach of the cold stage of the paroxysm. From the writings of Celsus we learn that the ancients employed the warm bath at the period of the anticipated accession. The bath was used half an hour before the rigor was expected; after which some sudorific medicine was administered, and, the patient being put into bed, the sweating, as soon as it occurred, was kept up by warm diluents. In a period nearer to our own times, Sydenham used to put his patients into bed, about four hours before the expected accession of the paroxysm, and excited sweating by the most powerfully stimulating sudorifics; keeping it up in the same

manner for several hours. But these means often served to heighten the symptoms of the hot stage by augmenting the heat of the system, and, instead of shortening the paroxysm, have protracted both it and the disease, and even converted intermittent into continued fever.

The most usual modes of inducing diaphoresis, in this case, is by means of an emetic. I am aware that it may be doubted whether the advantage derived from an emetic, in this stage of the paroxysm, be attributable to its diaphoretic effect, or to the agitation it produces proving a stimulus to the system in general; and, if we consider that other mechanical means —such, for instance, as running and violent muscular exertions—produce the same result, we shall be inclined to adopt that opinion which attributes the benefit to the stimulant effect of the emetic: at the same time it cannot be denied that the known sympathy between the stomach and the surface is such, that the nausea produced in the one is generally followed by diaphoresis in the other. Under all circumstances, however, this practice of producing sweating by vomiting is not admissible, especially where there is a determination of blood to the head, and consequently other methods of inducing sweating must be resorted to; and the best are either antimonials or ipecacuanha combined with opium. The opium may be given in the form of tincture, to the amount of forty drops at first, and then half that quantity repeated every quarter of an hour, for three or four successive times. By whatever means the sweating is induced, it should be kept up until the paroxysm has run its course and declined; and this is best effected by tepid diluents; but, if the catenation be not broken, and the hot stage has come on, then cold fluids are more grateful to the patient, and also more beneficial in other respects. With regard to a repetition of these means, we must be guided by the effects produced: thus, if the paroxysm be only alleviated, the Diaphoretics should be repeated under the same circumstances; if it be stopped, and there be some appearance of a return, then they may also be repeated: but, when the strength is deficient, this method cannot be carried far without incurring some risk. In the selection of Diaphoretics, we must employ the stimulating

during the interval, not only to diffuse the blood over the system, and maintain the cutaneous function, for the immediate purpose of warding off the paroxysm, but also to support the tone of the extreme vessels: while, in order to subdue the paroxysm when present, the nauseating and relaxing Diaphoretics are preferable.

2. For fulfilling the second intention of administering Diaphoretics in intermittents—namely, to shorten the hot stage by promoting a flow of sweat—emetics have been also employed; but vomiting is certainly not so well suited to this as to the first stage of the paroxysm; and every indication may be better fulfilled by nauseating Diaphoretics, particularly antimonials, combined with opium. The best Diaphoretics for this purpose are the tartrate of antimony and potassa, or the true James's powder, or ipecacuanha combined with opium, in the form of Dover's powder, with the addition of a small portion of ipecacuanha, to secure its nauseating effect. It was well observed by Dr. Lind that opium has a marked power in this stage of intermittent—a circumstance which is to be ascribed rather to its stimulant influence, exerted at the moment that the nauseating effect of the Diaphoretics combined with it relaxes the surface, than to its sedative powers. But, in paying this tribute to opium, it is requisite to state that, if symptoms of synocha prevail, then opium and all stimulants are to be avoided. In this state, the saline mixtures, the citrates and acetates of ammonia, and the citrate of potassa, given in a state of effervescence, the vegetable acids and blood-letting, are indicated; particularly when the pulse is hard and full, and difficulty of breathing or dyspnœa is urgent.

When the diaphoresis is actually induced, nothing further is requisite than to maintain it by the mildest tepid diluents; to keep the patient in flannel; and, if the sweating continue long, to support the strength by gentle cordials.

3. With regard to the third intention of administering Diaphoretics in ague, although sudorifics cannot be recommended to be given during the interval, yet nothing tends more to prevent the recurrence of the paroxysm than the keeping up the proper cuticular discharge; and the stimulat-

ing Diaphoretics are the best adapted for fulfilling this intention. Some writers on the treatment of intermittents, however, contend that the mildest are to be preferred. Both opinions, to a certain degree, are correct; the propriety of employing the stimulant or the milder Diaphoretics in the apyrexia depending altogether on the temperament and state of the patient, independent of the disease. Thus, if the pulse be strong, full, or hard, if there be present pains resembling those of rheumatism or pleurisy, or any other symptoms of a naturally inflammatory habit, however complete the interval or apyrexia may be, stimulant Diaphoretics ought not to be exhibited; but, if the contrary be the case, or if the continuance of the disease have reduced, as it generally does, this diathesis, then the most useful Diaphoretic is the serpentaria; and it may be advantageously combined with sulphate of quinia or any other tonic. The salts of ammonia, especially the carbonate, have also been added to the cinchona bark for this purpose; and it has even been asserted that much of the benefit arising from the use of arsenic is owing to its promoting the cuticular discharge, along with its tonic effect. The climate, the age of the patient, and the nature of the prevailing epidemic, are also to be taken into account in prescribing Diaphoretics in the intermission or apyrexia of ague. All debilitating causes, not less than the power of habit, tend to protract these fevers; and, therefore, taking every incident into consideration, we may regard it as a general rule that the stimulating Diaphoretics are more frequently required than the milder and relaxing in the apyrexia of intermittents.

In continued fevers, sweating has always been regarded as one of the most important means of securing a crisis. In using this term, it is not intended to imply that any peccant matter is thrown off, as was once supposed. A natural or spontaneous crisis in fever seldom occurs after the tenth or twelfth day after the disease has displayed itself; and an artificial crisis—that is, a crisis induced by remedial agents—is rarely induced after the third or fourth day. The sooner after the appearance of the fever that the attempt to produce a crisis is made, the more probable is the chance of success.

In continued fever, sweating is generally accompanied with an abatement of the symptoms, and is the process of Nature in relieving fevers. Where relief is obtained by spontaneous sweating, this is always thin and generally diffused; and we may rest assured that, under no other circumstances, does sweating prove beneficial in continued fever.

The benefit resulting from sweating in continued fever cannot be denied; but, at the same time, it must be admitted that several circumstances are requisite to be kept in view to secure its beneficial effects.

In the first place, the type of the fever should be carefully determined. This is of great importance, in as much as the first effect of many sudorifics is to increase the force of the heart and arteries, and consequently to augment phlogistic symptoms. In synocha, therefore, or rather in that stage of continued fever in which inflammatory symptoms prevail, if we employ Diaphoretics, the mildest must be selected; and, even in fevers attended with great depression, the administration of stimulant sudorifics requires considerable precautions.

In the second place, the period of the fever must be kept in view. Every continued fever may be divided into three periods. 1st. That of accession; 2nd. that in which the fever is fully formed; and 3rd. that in which it shows a tendency to terminate, whether in death or in recovery. Sudorifics have been found most successful in the first period; and this seems to depend on the nature of every fever, which being a succession of paroxysms, the means which arrest the first may stop altogether those which should follow; and also on the fact, which experience has confirmed, that the chance of a fever being cut short by sweating is diminished the longer it continues. When a continued fever is completely formed, although it is impossible to prevent it from running its particular course, yet sudorifics may be of advantage in obviating the violence of the symptoms; and they may often prove most beneficial, even at later periods, if given about the commencement of the exacerbations. If much debility, however, be expected, and the Diaphoretics we have administered do not quickly relieve the symptoms, then their use should not

be continued. As the last stage of continued fever is one of debility, and sudorifics, from their stimulant and evacuant effects, exhaust the powers of life, sweating is not to be promoted in this stage of the disease.

The symptoms that chiefly indicate the use of Diaphoretics in continued fever, are considerable arterial action, a small and concentrated pulse, thirst, a dry skin, heat, restlessness, and limpid urine without sediment; but a strong pulse, a great determination to the head or the thorax, spontaneous sweating, general or partial, especially if attended with a miliary eruption, strongly contraindicate the employment of Diaphoretics. In every case in which sweating is likely to prove useful, it flows readily and is general: on the contrary, when it flows with difficulty, it is partial and inconsiderable, and is seldom salutary; if the febrile symptoms increase, it is even dangerous.

In the treatment of intermittents it was formerly the practice to extort sweating by violent stimulating means; but this is highly improper, both in continued fever and intermittents; for, even when sweating is induced, if it do not produce a rapid abatement of symptoms, it will be generally found to have an injurious effect by reducing the strength of the patient. When sweating is to be excited, therefore, the mildest means should be employed; and no medicines are more easily regulated for this purpose than the antimonial preparations. Whether James's powder or emetic tartar are to be preferred, it is difficult to determine: as far as regards the due action by the skin, my own experience would make me lean to the side of the emetic tartar, both on account of its certainty of operation and the facility with which its dose can be regulated. In checking such sweats, however, whether they are spontaneous, or the consequence of stimulant sudorifics and external heat, we must cautiously avoid the application of cold to the surface. The best mode of lessening it is by moderate purging; employing the saline purgatives acidulated with diluted sulphuric acid.

The importance of the internal and external use of cold and warm water in febrile affections, cannot be sufficiently urged. The immediate effects of the cold affusion are a

diminished degree of heat, and of the frequency of the pulse, followed by diaphoresis and sleep. It is in the commencement of continued fevers, when the symptoms of synocha are present, that the cold affusion is most useful. In the more advanced stage of the disease, or where there is much debility, the tepid affusion, from 75° to 87°, is more advisable than the cold affusion. Under this term is also comprehended sponging, and washing the body with tepid water. The same cautions, however, are to be attended to, whether the tepid affusion or sponging and washing be employed*.

With respect to the internal use of cold water to excite diaphoresis in continued fevers, it is necessary to remark that it should be clearly understood, that it is only after the hot stage is completely formed, and when the temperature of the body is greatly above the natural standard, that cold water and cold drinks can be safely and advantageously administered. They produce effects exactly similar to those of the cold affusion, but in a less degree, diminishing the heat of the surface and the frequency of the pulse, and disposing to diaphoresis and sleep. After the sweating has become general, the farther use of cold fluids is undoubtedly inadmissible: but this does not refer to the commencement of the sweating, since at this time, as Dr. Currie remarks, they both aid in reducing the temperature of the body and in promoting the flow of sweat. It must, however, be recollected that much of the benefit resulting from promoting sweating in continued fever depends on the discrimination and judgment of the practitioner: for, without due consideration, a remedy calculated to produce much benefit, may be followed by consequences not only hurtful, but fatal.

In the phlegmasiæ, sudorifics are not so generally indicated as in idiopathic fevers, particularly such as, in the first instance, excite the action of the heart and arteries. In acute rheumatism, however, they are much employed. Spontaneous sweating is one of the symptoms of the disease, and, as

* See Currie's Medical Reports on the Effects of Cold and Warm Water in the Treatment of Fevers: the Observations of Dr. Wright in the seventh volume of Medical Facts and Observations: and Dr. Jackson's Treatise on the Fevers of Jamaica.

experience has pointed out that its appearance always relieves the pain, the use of Diaphoretics is considered to be particularly indicated. Acute rheumatism, nevertheless, is now seldom treated with sudorifics; for, if it do not rapidly relieve the pains, the disease invariably increases in violence.

When gout was considered to depend upon the presence of some morbific matter in the habit, which required to be expelled, the skin was supposed to be the natural emunctory for this purpose, and Diaphoretics were freely employed. The more correct view which is now taken of this painful affection has set aside this practice in a great degree; but, still, after purging and the use of sedatives, Diaphoretics are employed as useful auxiliaries. There can be only one opinion respecting the propriety of employing sudorifics in dysentery: and if antimonials be preferable in continued fever, ipecacuanha, in combination with opium, is here our best hold. It may be given in large doses, in combination with extract of gentian, which prevents it from exciting vomiting, as recommended by Mr. Twining, in the Calcutta Transactions. In doses of from three to six grains, administered in this manner, it allays irritation and tenesmus, and aids the favourable termination of the disease more decidedly than when nausea is induced. The general covering of the body should be light, but of a non-conducting character.

Among the ancients, sweating was very commonly employed for the cure of dropsy, and it has been also used by the moderns. The indications in dropsy requiring the use of Diaphoretics is the harsh dry skin which frequently accompanies this disease. Sweating may be employed in some cases of dropsy with advantage; but it cannot be regarded as generally applicable. Sudorifics are useful when disease of the lungs is present. After sweating, the excretion of the urine is sometimes increased, and the accumulation of the dropsical fluid so much diminished that a bandage is required; but, as it is probable that these effects depend on the reduction of the inflammatory diathesis, this is more quickly and effectually produced by the use of the lancet than by Diaphoretics. There is no doubt, however, that sudorifics are use-

ful auxiliaries in the management of dropsy; they are, however, in many instances of this disease, much less useful than cathartics; but they have one advantage, of not impeding the other methods of cure.

In cutaneous diseases, Diaphoretics have been found beneficial, particularly the antimonials. All the preparations of Mercury which have proved beneficial in these troublesome affections owe much of their efficacy to their effect on the capillary vessels of the skin; and, as in some varieties of intermittent, the beneficial effects of arsenic have been ascribed to its producing diaphoresis. Many of the vegetable remedies which have been found useful in skin diseases belong to this genus of medicines; and we may ascribe the benefit derived from the employment of the warm bath chiefly to its diaphoretic influence. The very cleanliness which is so peculiarly necessary in cutaneous diseases, can only act by promoting the natural function of the skin. Many of the remedies used in syphilis are sudorifics; such, for instance, as sarsaparilla, mezereon, guaiacum, and even mercury and antimonials. How far the beneficial effects are due to their diaphoretic powers, I will not venture to decide. In warm climates, where there is a constant determination to the skin, those substances not of a mercurial nature have succeeded more generally in curing the disease than in colder regions; but certainly it would be supposing too much to ascribe the cure to the syphilitic poison being thrown off from the surface by the diaphoresis. I am of opinion that we must look a little beyond our own art to ascertain the causes of the easy cure of syphilis in warm climates; to the relaxed habits of the natives; to their simple and mild diet, and even to the degree of indolence and rest which is the natural consequence of a tropical climate; nevertheless it is certain that, in the treatment of syphilis, diaphoresis in the commencement is of great importance.

Diaphoretics are advantageously prescribed in many other morbid affections; but it is unnecessary to enter further into details; enough has been said to show their general importance in the treatment of diseases.

SECTION XVIII.

EPISPASTICS.—MEDICAMENTA EPISPASTICA.

Epispastics, in the ancient acceptation of the term, meant substances which inflame the skin; but the term includes also substances which cause either *vesication* or *suppuration*. The ancients arranged Epispastics according to the degrees of effect which they produced; the first or slightest they named *phœnigmoi*, the next *sinapismi*, the third *vesicatorii*, and the fourth, or most powerful, *caustici*. This division is extremely judicious; but the latter term caustici is too general a phrase, comprehending not only caustics which destroy the vitality of the part, by the excess of their stimulant power, such as the actual cautery, but those, also, which operate by their chemical properties, and which I shall notice under the head *Escharotics*, in that division of our arrangement which treats of remedies which act upon the body by their chemical properties. I have, therefore, arranged Epispastics under the following four divisions:—1, *Rubefacients;* 2, *Vesicants;* 3, *Suppuratives*; 4, *Actual Cauterants*. The two first of these divisions differ rather in the strength than in the nature of the applications.

In whichever manner Epispastics operate, their immediate influence is exerted on the skin; but their secondary on distant organs. Nature confirms the truth of this remark, by displaying the powerful influence of cutaneous eruptions over functional diseases of internal organs: even in exanthematous fevers, the febrile action generally subsides as soon as the eruption appears; nor is the occasional opposite effect any argument against the general result.

1. Rubefacients are substances which redden the skin, by exciting moderate inflammation of the capillaries, and produce a certain degree of pain by stimulating the extreme nerves of sensation. This may be effected by *mechanical*, *chemical*, or *vital* means.

The effect of a moderate Rubefacient is purely local; in augmenting the action of the cutaneous capillaries, it operates as a counterirritant; but that of a powerful Rubefacient is ge-

neral, the excitement which it causes extending over the whole habit. Thus, if a liniment, composed of two parts of fixed oil and one part of ammonia, be rubbed on the neck, in inflammation of the tonsils, the inflamed organs are relieved by the inflammation set up on the surface acting as a counterirritant; but if these proportions be reversed, diaphoresis is also induced, and the febrile symptoms are mitigated in violence. In stating this effect, however, of Rubefacients, it is necessary to remark, that when they are applied to relieve local pains, or inflammation not accompanied by general fever, they seldom operate in this secondary manner. The general operation, therefore, of Rubefacients may depend on a change of morbid action begun in a part and extended by sympathy to the whole of the system; it must, consequently, be regarded as accidental. In this case, the local action more than counterbalances the general excitement, and produces what is termed a derivation of action.

Another effect of Rubefacients is to be referred to the pain which they induce diverting the attention of the patient from the seat of morbid action. In treating of the influence of mind in modifying the operation of medicines, I pointed out the difficulty of curing some painful diseases as long as the attention is powerfully directed to the seat of the disease: Rubefacients operate by withdrawing this, and thereby enabling the natural efforts of the system to repair any irregular action in the affected part. If the influence of the Rubefacient can be maintained for a sufficient length of time, the diseased action which it had arrested will not return; thence, in many instances, the proper employment of this variety of Epispastics is productive of much benefit in internal inflammations, in scrophulous affections of the joints and in strumous swellings. It has been contended that Rubefacients owe much of their benefit to the friction employed; but in many cases no friction is used.

2. Vesicants.—Most of the substances operating as rubefacients, when much augmented in strength, cause an effusion of serum between the cutis vera and the cuticle, and thus become vesicants. The primary action of a vesicant, therefore, is that of a rubefacient, extended beyond the or-

dinary limit: the heat, redness, swelling, and pain, are greater; and the result of this increased action is the effusion just mentioned. The skin being an exhalant organ, a large quantity of fluid is thrown off by it, in the usual exercise of its healthy function; and this is increased when the extreme vessels are excited: but still the cuticle is sufficient to transmit this within a certain limit; and it is only when the inflammatory action exceeds this limit that vesication occurs. Perhaps something is also due to the effect of the hasty secretion of the serum, which, containing a larger quantity of coagulable matter than in its usual state, the cuticle, calculated only to transude a thin fluid, is incapable of allowing this denser fluid to pass through it; and thence it is forcibly raised from the true skin by the fluid so largely thrown out beneath it. The serum of blisters has been chemically examined by M. Magueron, in the Hôtel des Invalides: he found that it contains a much larger proportion of albumen than exists in the ordinary exhalation from the skin. In one hundred parts of the fluid of a blister, he obtained eighteen parts of albumen, two of muriate of soda, one of carbonate of soda, one of phosphate of lime, and seventy-eight of water. He ascertained that the nature of this fluid is the same, by whatever agent the blister is produced, whether by vesicants properly so called, or by sinapisms, or by hot water, or by the stings of insects.

The benefit arising from blisters was formerly ascribed to the discharge which the vesicant produces; but it was first observed by Stoll that this is too small to be productive of much benefit: thence he remarks, "non suppuratio sed stimulus prodest;" and it is on this account that the repetition of blisters in inflammation of mucous membranes is more useful than a continued discharge from one. It is true that the effusion of serum internally is checked by blisters; and it has been affirmed that they effect this by "extracting serum from the mass of blood in the adjoining vessels:*" but, if the counterirritant lessen the determination of blood to the internal organ, the effusion of serum will necessarily be lessened, independent of any diminution of this compo-

* Cyclopœdia of Practical Medicine; art. Counterirritation.

nent of the blood which a blister can effect. If the degree of morbid action be lessened, the consequences of high action will not follow.

The benefit which blisters produce is to be attributed to their local stimulant action, as counterirritants, and the sympathy which exists between the skin and the mucous and serous membranes. This was known to the ancients: Hippocrates, who invented them, applied them in the hope of transferring diseased action from the interior to the surface, or, as it has been termed, on the doctrine of revulsion.

Besides the local effect of blisters, their stimulant influence is sometimes useful in rousing the general powers of the system in low fevers, and in subduing states of inordinate action of the moving fibres. They have even been found to influence the mental energies; and thence have been applied by men engaged in public business when great displays of oratory where required*; but, although their first or exciting effect be communicated to the mental faculties, yet their secondary effect is that of depressing the spirits; and, on this account, the action of a blister is followed by a disposition to sleep. The general stimulant influence of blisters points out the necessity of caution in their application, until excitement be reduced by bleeding, purging, and other depleting measures, in inflammatory diseases.

It has been asserted that blisters ought not to be applied over parts covered with an erysipelatous eruption; but this precaution is unnecessary: on the contrary, the new action induced by a blister is often productive of the most permanent sanative results. They are, however, contraindicated in several conditions of the habit; for example, when the excitement which they induce is likely to be followed by collapse. It is on this account that children do not bear blistering with impunity, and sometimes suffer from phagedenic ulceration after the application of a blister. I have seen even gangrene and death follow the application of a blister on an infant. This effect of blisters on children, however, may be prevented by ne-

* This was the custom of the celebrated Dunning the barrister; and my friend, the late Sir James Mackintosh, informed me that he had once tried the influence of a blister when he had to make a display in the House of Commons, and had every reason to be satisfied with its effects.

ver allowing the blistering agent to remain longer applied than is absolutely requisite for exciting the degree of inflammation to raise the cuticle: thus, if the plaster of cantharides be used, it should be removed in four or six hours at the utmost. When a disposition to phagedena or gangrene displays itself, the local application of the chlorides and poultices, with the administration of tonics internally, should be immediately resorted to. Blisters, as I have already stated, are frequently employed to rouse the powers of the habit in the low stages of fever, particularly in typhus; but, when the powers of the system are much reduced, they should not be applied to the feet and ankles; for they either fail to rise, owing to the very diminished excitability of the part, or, if they act, the blistered surface is apt to run into gangrene. Vesicants are, in fact, to be regarded as counterirritants rapidly exerting their influence; and, as we shall afterwards find, they are, in this point of view, remedies of considerable importance.

3. SUPPURATIVES do not produce their effects in a manner similar to *rubefacients* and *vesicants*. The inflammation produced by the two latter is erythematic; that excited by suppuratives is phlegmonous. Suppuratives differ from actual cauterants in degree: the former cause inflammation which terminates in small pustules, which run their course, suppurating freely: the second produce deep-seated ulceration and destruction of the part to which they are applied.

The advantage of suppuratives is the permanence of the effect; and, in this variety of Epispastics, some part of the benefit derived is due to the discharge and the continued derivation of a large supply of the circulating fluid to the part. Much of the effect, however, depends on the nature of the suppurative employed, and the manner in which it is applied. In one particular, they differ materially from both rubefacients and blisters: after they have been in continued action for some months, they cannot at once be discontinued without considerable risk. Thus, apoplexy has occurred almost immediately after drying up an issue, in the same manner, and on the same principle, as when a sore leg or an old ulcer has been suddenly healed. The difference between the discharge from the operation of a *vesicant* and a *suppurative* depends

upon the action of the former being confined to the capillaries or exhalant vessels; whilst that of the latter is extended to deeper-seated and more important arterial branches: the inflammation, as I have already said, in the one case resembles that which is termed erythematic; in the other, that which we denominate phlegmonous.

4. ACTUAL CAUTERANTS destroy the life of the part to which they are applied, and excite the energies of the surrounding parts to a degree approaching to inflammation, which enables them to throw off the dead matter or eschar. The stimulus which is thus communicated to the healthy parts is readily maintained by mechanical and chemical irritants, introduced into the ulcerous cavity; and these, causing a determination of blood to the part, operate as contrastimulants: in this manner, the actual cauterant becomes a suppurative. But, in the first instance, the shock communicated to the nervous system by the application of so powerful an agent as the actual cautery is considerable; and, while we know that, in certain diseases, this is highly salutary, the knowledge of it is sufficient to guard us against its indiscriminate employment. A question may arise respecting the cause of the efficacy of actual cauterants—whether, like blisters, something be not due to the degre of pain which they excite diverting the attention from the seat of disease? In reply, it may be stated, that the effect is often produced before a degree of vascular action is set up sufficient to cause much pain; and that, in some cases, scarcely any pain follows, and yet a powerful change is effected in the habit.

TABLE OF EPISPASTICS.

A. SUBSTANCES WHICH IN CERTAIN QUANTITY, OR DILUTED, OPERATE AS RUBEFACIENTS.

* *Organic Products.*

a.—ACRID OIL, contained in

Bulbs—Allium *Sativum.*	6. 1.	Asphodeleæ.
Fruit—Capsicum *annuum.*	5. 1.	Solaneæ.
Seeds—Sinapis *nigra.*	15. 2.	Cruciferæ.

b.—VOLATILE OILS,

Oil of Turpentine.
Oil of Cajuput.

*** Inorganic Substances.*

c.—AMMONIA.

d.—ACIDS.

e.—HOT WATER.

B. SUBSTANCES WHICH OPERATE AS VESICANTS.

** Organic Products.*

Animal.

a.—CANTHARIDEN, contained in

Cantharis *officinalis*.	4. 5.	Crustacea,	Coleoptera.
——— *vittata*.	–. –.	———	———
Mylabris *variabilis*.	–. –.	———	———

Vegetable.

b.—ACRID OIL, contained in

Roots—Ranunculus *acris*.	13. 7.	Ranunculaceæ.
——— *sceleratus*.	—. –.	———
Seeds—Sinapis *nigra*.	15. 2.	Cruciferæ.

*** Inorganic Substances.*

c.—AMMONIA.

d.—NITRATE OF SILVER.

e.—STEAM.

f.—HEATED METAL.

C. SUPPURATIVES.

** Organic Products.*

a.—ACRID OIL, contained in

Bulbs—Lilium *album*.	6. 1.	Liliaceæ.
Barks—Daphne *Gnidium*.	8. 1.	Thymaleæ.
——— *Mezereum*.	–. –.	———

b.—Oleo-Resins.

Burgundy Pitch.
Galbanum.
Ammoniacum.

** *Inorganic Substances.*

c.—Acids.

d.—Tartrate of Antimony and Potassa.

*** *Mechanical Means.*

e.—Issues.

f.—Setons.

D. SUBSTANCES WHICH OPERATE AS ACTUAL CAUTERANTS.

a.—Moxa, formed of

Artemisia *Chinensis*. 19. 1. Compositæ.

b.—Caloric, communicated by

White-hot Iron.

A. ORGANIC SUBSTANCES WHICH OPERATE AS RUBEFACIENTS WHEN APPLIED TO THE SKIN.

a. ACRID OIL.

This epispastic agent is never employed in its separate state; but, in its natural combinations with resin and other vegetable constituents, it forms the active rubefacient principle of the following substances.

1. Garlic. *Allii sativi Bulbus.* L. E. D.—The plant of which this is the bulb, is a native of Sicily, belonging to the natural order Asphodeleæ: it is cultivated in every part of Europe*. The bulbs of Garlic are small, and congregated together in a common membrane. The separate bulbs are named *cloves*. They have a strong, disagreeable, penetrating odour, and an acrid taste. According to the analysis of Bouillon

* Woodville's Med. Bot. 3rd edit. p. 749, pl. 256, London Dispensatory, art. Allium.

Legrange, they contain albumen, saccharine matter, fecula, and the acrid volatile oil on which their rubefacient property depends. On distillation with water, the cloves of Garlic yield this oil: it is at first yellow, and lighter than the water; but, as the distillation advances, it becomes heavier. It is so acrid, that in its separate state, undiluted, it rapidly blisters the skin; and is so penetrating that, when applied to the surface, even to the soles of the feet, its odour is soon detected in the breath; and, when garlic is taken into the stomach, the odour is perceptible in the discharge of issues. This acrid oil has some degree of volatility, but not much; for the odour seems to depend upon another volatile oil, intimately combined with this acrid oil. The acrid principle is extracted by alcohol and vinegar.

Garlic is not much used as a rubefacient, owing to the disagreeable nature of its odour; but it has been found useful as a local stimulant in atonic deafness. In deficient action of the urinary bladder, a poultice of Garlic applied over the pubes rarely fails in producing the discharge of the urine. It is scarcely necessary to caution against its employment, even as a rubefacient, in inflammatory states of the habit.

The bulb of the Onion, Allium *cepa*, and that of the Leek, Allium *porrum*, indeed the bulbs of all the species of Allium, possess rubefacient powers; but, on account of their offensive odour, they are seldom employed.

2. CAPSICUM. *Baccæ Capsici Annui.* D.—The Capsicum *Annuum* is a native of South America, an annual, easily cultivated in this country, bearing its fruit ripe in September*. It is arranged in the natural order Solaneæ. The fruit, which is the officinal part of the plant, is a juiceless berry, conical or ovate; of orange, red, green, or yellow colour; two-celled, with reniform seed. The best cayenne pepper is made from bird pepper, Capsicum *baccatum*. It is often adulterated with salt, sometimes with red oxide of lead: the former is detected by the taste: the latter, by boiling the pepper in vinegar, and adding sulphuretted hydrogen water; if a dark precipitate be thrown down, lead is present.

* Woodville's Med. Bot. 3rd edit. p. 226, pl. 80. London Dispensatory, art. Capsicum.

The odour of the berry, when recent, is aromatic; but this is impaired by drying; the taste is hot and acrid, leaving its impression long on the palate. Hot water takes up the active principle of Capsicum: the acids and alkalies do not affect the watery solution; but it is altered by muriate of lime, by bichloride of mercury, carbonate of potassa, salts of baryta, sulphates of iron, of zinc, and of copper, acetate of lead, nitrate of silver, and lime water. Infusion of galls also throws down a precipitate.

The watery decoction, evaporated to dryness, affords a residue resembling starch in consistence. When Capsicum is boiled with alcohol and strained, the solution deposites, on cooling, a fatty matter of a beautiful orange-red colour, which is excessively acrid, but possesses no volatility: on distilling the alcohol from it, no acrid principle comes over with the spirit. On dissolving the residue, or rather mixing it with boiling water, the fluid becomes very pungent and acrid; and, when evaporated to dryness, leaves a residue, from which ether takes up a yellow orange-coloured oil. This is the acrid principle of Capsicum. The acrid principle of Capsicum, therefore, has the character of a fixed oil, but differs in being soluble in water. It is very soluble in weak, cold alcohol, and in solution of potassa. It gradually acquires the consistence and appearance of wax when long exposed to the air and light.

The residue, after the action of alcohol on Capsicum, is a gummy matter of a mawkish taste, combined with a red colouring principle; it has not the adhesiveness of gum, and approaches rather to the character of jelly than that of gum. According to the analysis of Braconnot, Capsicum consists of *fecula*, acrid fixed oil, a red waxy matter, a gummy matter, animalized matter, citrate of potassa, muriate and phosphate of potassa.

As a rubefacient, Capsicum is not much employed in England; but, in the West Indies, cataplasms of it are applied in the same manner as mustard cataplasms in this country; and it is preferable to mustard, from its effects as a rubefacient being equal, with less hazard of vesication, which, in low

states of fever, when such cataplasms are employed to relieve coma and low delirium, is always hazardous. Capsicum cataplasms have been used with advantage in sciatica and chronic rheumatism, when local stimulants are required. The tincture, evaporated to the consistence of a thin extract, and spread over the pained part, is even more useful than the cataplasm.

Some individuals, troubled with cold feet, have derived benefit from wearing socks, dusted with cayenne pepper.

3. Flour of Mustard. *Sinapis Nigræ Farina.* L. E. D.—The acrimony of Mustard depends on an acrid oil, which remains on the marc after the bland oil contained in the seeds has been expressed. If flour of mustard be rubbed on the skin, or cataplasms, made with equal quantities of crumb of bread and flour of mustard, kneaded into a pultaceous paste with water, be applied to it, redness, pain, and inflammation, are very rapidly induced. It is difficult, however, to regulate the mere rubefacient influence of Mustard: it very frequently excites vesication, and, in that case, may prove injurious. Mustard, as a rubefacient, is generally thought to be improved in activity when vinegar, instead of water, is used for making the cataplasm; but this depends greatly on the kind of Mustard employed. The brown Mustard, which often contains the husk of the seed as well as the flour, is injured by vinegar; whereas fine yellow Mustard, composed solely of the farina, is equally efficacious, whether water or vinegar be used for making the sinapism: alcohol injures its powers. Recently ground flour of Mustard is more active than that which has been long kept.

When sinapisms are applied to the skin, their first effect is heat on the part, which increases to burning of almost intolerable intensity, so that a patient can seldom support it: a sensation of general fulness, with throbbing of the temples, follow. The rubefacient effect is not equal to the intensity of the pain; and it seldom takes place until after the sinapism be removed, and the skin long remains of a deep crimson or purple hue. If the plaster be too long left on the place, vesication and even gangrene have been known to ensue:

thence, in cases where the sensibility of the patient is low, sinapisms should not be allowed to remain on longer than an hour.

Sinapisms are valuable remedies when it is important to raise a quick and efficient counterirritant effect; and as no absorption takes place, they are less objectionable in cases of general inflammation than garlic. They are indicated in all cases of local determinations, and in low states of the vital functions, as in typhus fever.

b. VOLATILE OILS.

All volatile oils are local excitants, and consequently may be employed as rubefacients; but two only are specially used as such.

1. OIL OF TURPENTINE. *Oleum Terebinthinæ.* L. E. D. —This oil may be employed either in its separate state or in combination in what is termed Burgundy pitch. This resinous substance is collected by wounding the bark of the Norway fir, and afterwards boiling the concreted juice in water and straining it through cloths in a press. It is only moderately rubefacient; and consequently its use is confined to cases where slight counterirritation is desirable; as in the coughs of children and of old people, when it is applied to the chest, spread on leather, in the form of a plaster.

2. CAJUPUT OIL. *Cajeputi Oleum.* L. E. D.—This oil, when diluted with an equal quantity of olive oil, is a useful Rubefacient in gout and rheumatism, and aids also in restoring vigour to joints weakened by sprains. It possesses, however, no particular advantages over any other volatile oil.

* * *Inorganic Substances.*

c. AMMONIA. L. E. D.—For rubefacient purposes, pure Ammonia is extricated from the decomposition of muriate of Ammonia by the mineral alkali contained in soap. A plaster is made by melting together ℥i of soap and ʒii of common litharge plaster; and, when nearly cold, ʒi of muriate of Ammonia in fine powder is added to it. From this nearly a

scruple of Ammonia in a pure state is extricated and exerts its action on the skin at the moment of its extrication. Too much of the muriate should not be used, as the first action is less than that which follows, owing to the inflammation induced. If it be requisite to maintain the rubefacient effect, the plaster must be renewed as soon as the decomposition of the muriate is completed ; but the quantity must be successively less in each plaster after the first. Where the quick influence of a rubefacient is required, as in attacks of violent spasm in the viscera of the thorax or the abdomen, or in gout in the stomach, and similar affections, this is a very useful form of rubefacient.

The solution of pure Ammonia, softened by being formed into a kind of soap with bland oil, is also a useful and very frequently employed rubefacient. It is one of those superficial excitants which extends its action to the general system, and usually causes diaphoresis ; a quality of great importance in many local inflammations when the strength will not admit of the employment of the lancet or much depletion. The proportions of the Ammonia and the oil may be equal ; but some habits of little susceptibility require two parts of the Ammonia to one of the oil.

d. ACIDS. The *Sulphuric Acid*, combined with ten times its weight of lard, forms a liniment which produces a rubefacient effect when it is applied to the skin. The *strong Acetic Acid*, when diluted with an equal weight of water, reddens the skin, and may be employed as a rubefacient. But neither of these acids are much employed for rubefacient purposes.

e. HOT WATER.—Moderate degrees of heat—namely, between 120° and 150°, especially in combination with water —act as rubefacients on the skin. Poultices and fomentations, therefore, are often successful in removing, by counter-irritation, slight internal inflammations. A rubefacient property, joined to the pediluvium, by augmenting its temperature, aids greatly its derivative influence. Fomentations also, when used very hot, relieve spasmodic affections: and this can be referred only to their rubefacient influence.

B. SUBSTANCES WHICH OPERATE AS VESICANTS, AND WHICH, PROPERLY DILUTED, MAY BE EMPLOYED AS RUBEFACIENTS.

* *Organic Products.*

Animal.

a. CANTHARIDEN.—This substance (vol. ii, p. 400) is the active principle of the Spanish fly, or blister beetle, Cantharis *officinalis:* it is that also of the Potato fly, Cantharis *vittata*, which is employed as a vesicant in America; and that of Meloe *niger* and Mylabris *variabilis*. The latter is a Coleopterous insect, which has been lately introduced from China, as a vesicating agent, and which seems to possess in an eminent degree all the vesicant properties of the blister beetle. The Meloe *niger* is stated to have the advantage of not causing strangury: nevertheless it has not been employed as a vesicatory in this country, although sixteen years have passed since its properties were known; nor has it been determined whether its active principle is Canthariden.

The Emplastrum Cantharidis of the Pharmacopœias is the substance commonly applied for producing a blister in this country; some disadvantages, however, attend its employment. It consists of one part of finely powdered Cantharides, blended with one or two parts of wax plaster. In the first place, the formation of the plaster by heat injures the activity of the Cantharides; and, in the second place, there is great waste in this mode of proceeding, as only those particles of the powdered insect which are upon the surface are of use. It would, therefore, be much better if some kind of semi-adhesive paste were contrived for forming the basis of the plaster, upon which the powdered Cantharides could be sprinkled before applying the plaster to the skin. Were Canthariden easily prepared, the most certain blister would be a solution of that substance in oil; but the tediousness of the process, and the smallness of the product, render it impossible to employ it for ordinary purposes.

The application of the plaster of Cantharides produces, first, a sensation of heat and pricking in the part, attended with

some general excitement and increased quickness of the pulse: if it remain on a sufficient space of time—namely, from six to ten hours—the cuticle is raised, and betwixt it and the true skin a yellowish serum is deposited. Sometimes fresh blisters continue to rise around the first blister after the plaster has been removed. Both the degree of excitement, and the character of the effused serum, and its quantity, are greatly modified by circumstances connected with the general habits of individuals and the disease for which the blister is applied.

In many individuals, the acrid principle of the insect is carrried into the circulation and produces strangury; and this is more general when the part on which the blister is to be applied is the scalp. In this case, the hair should be removed some hours before applying the blister, if the necessity of the case admit of delay. The usual time for permitting a blistering plaster to remain applied is ten or twelve hours, when it is usual to puncture the blister, and, after discharging the fluid, again to apply the plaster. This is a practice which is to be reprobated, in as much as it does not answer any beneficial purpose, and it favours very much the absorption of the Canthariden, and the consequent production of strangury. As soon as a blister has risen, it ought to be removed, and the fluid discharged. In children, in particular, this rule should always be attended to; as, owing to great irritability of skin, they are not only more easily blistered than adults, but when the blistering plaster is permitted to remain too long applied, spreading, irritable, sometimes gangrenous ulcers are apt to supervene. When this happens, the strength of the patient must be sustained by bark, or other tonic medicines, the irritability of the part soothed by poultices made with a strong decoction of poppies, and every method which can change the irritable state of the habit into one of tone must be adopted.

Blisters, by whatever means they are raised, should be applied as near as possible to the affected part They should also be as large as the nature of the part will permit; large blisters giving no more pain than small. In every instance, the blistering plaster should be kept in close contact with the skin

by a few strips of adhesive plaster or a bandage; nevertheless, the pressure ought not to be great, as it may restrain the inflammation of the capillaries and prevent vesication.

It is of importance to prevent strangury. This is best effected by interposing something between the blistering plaster and the skin, so that they may not come into immediate contact, and yet not to prevent the necessary degree of stimulus required for securing the vesication. Gauze, or muslin, or thin paper moistened with oil, pressed down upon the blistering plaster, answers the purpose effectually; and, at the same time, enables the plaster to be removed in a more cleanly manner. When the tendency to strangury is great, the surface of the blistering plaster should be sprinkled with a little powdered muriate of morphia. It is also prevented by not permitting the blistering plaster to remain on longer than necessary to effect vesication, which takes place generally at the distance of eight hours, even if the blister have been removed two hours before, and no vesication be then present. When strangury occurs, it is allayed by diluting freely, and introducing a pill containing a few grains of opium within the rectum, or throwing into the gut a pint of warm water containing from thirty to fifty minims of the tincture of opium.

** *Vegetable Substances.*

b. ACRID OIL.—This is the active vesicating agent in the following vegetable substances.

1. CROWSFOOT RANUNCULUS, Ranunculus *acris*. D.—WATER CROWSFOOT, Ranunculus *Sceleratus*. D.—Both of these species of Ranunculus possess powerful vesicant properties. The first of them, the Ranunculus *acris**, or upright Meadow Crowfoot, is an indigenous plant, belonging to the natural order Ranunculaceæ. It is a common weed in pastures, flowering in June and July. The stem is creeping and horizontal, furnished with numerous fibrils on the under surface: it rises erect, sometimes to the height of two feet, branching into dichotomous or forked divisions, for supporting the flowers. The leaves spring from the root upon

† Woodville's Medical Botany, 3rd edit. p. 482, pl. 172. London Dispensatory, art. Ranunculus.

long petioles: they are deeply divided into three divisions, which are again subdivided. The flowers are large, terminal, of a brilliant yellow colour, and supported on villous, petiolated footstalks; the calyx is spreading and hairy, and the nectary covered with an emarginate scale. The leaves of this plant, when bruised and applied to the skin, rapidly inflame and blister.

The Ranunculus *sceleratus* and R. *flammula* are still more acrid plants than the other species of this genus. They are aquatic plants, with hollow, very branching stem, supporting leaves less divided than those of the former species. The flowers are yellow, numerous, and small; and the fruit a small cylindrical capital. All the parts of these plants are acrid; but the flowers and seed vessels are the most so, just before they are ripe. The only disadvantage attending the employment of these plants as vesicants, is, that they lose much of their acrimony when dried.

2. FLOUR OF MUSTARD. *Sinapis Nigræ Seminum farina.*—When a large proportion of Flour of Mustard is combined with a small proportion of crumb of bread and water, it quickly produces vesication, and proves extremely useful in all cases which require an immediate counterstimulant influence to be excited. It possesses no advantage over canthariden; and it has one disadvantage, that the sores caused by it are difficult to heal.

** *Inorganic Substances.*

c. AMMONIA.—When a piece of bibulous paper is soaked in strong solution of Ammonia, and applied upon the skin, it instantly produces a blister. Its operation is immediate; and thence its employment in spasms and sudden attacks of inflammation of the thoracic or abdominal cavities.

d. NITRATE OF SILVER. *Argenti Nitras.* L. E. D.—Although this substance is, strictly speaking, a chemical escharotic, yet it is also a vesicant when properly applied. For this purpose, the portion of the skin to be blistered is moistened, and a piece of the Nitrate passed lightly over it, first across and then in the opposite direction, so that the whole of the moistened surface may feel the influence of the caustic,

but not to an extent sufficient to produce an ulcer. In three or four hours a blister rises, the fluid of which is thick; and this being discharged by a puncture at the most depending part, it heals without any dressing. The advantage of this method of blistering over that by cantharides is the facility of the application, the rapidity with which the effect is produced, and the complete absence of general excitement, as no absorption of any kind takes place. It operates as a simple counterirritant, and can be quickly repeated so as to renew and maintain the impression. I have found it admirably adapted for pulmonary affections attended with much febrile excitement. Twenty of these blisters may be made over the surface of the thorax, in as many days, with the best effects. It is equally useful in affections of the joints and deep-seated pains. The only caution required in this employment of the Nitrate of Silver is moderation in its application: when too much is rubbed on the part, the pain is most excruciating, and its influence on the vascular system is sufficient to counteract any benefit which might result from its contra-stimulant property.

e. Aqueous Steam.—Water cannot convey caloric to act as a stimulus under a temperature of 98°; but it is not until it arrives at 180° that it is rubefacient; and at 212° its vesicating property is instantaneously exerted. This effect is not altogether local, as demonstrated in scalds: it excites generally the vascular system, quickening the pulse and producing febrile excitement. From the instantaneous manner in which the vesication is produced, the application of Steam might be very useful as a vesicant if it could be conveniently applied. Various modes of applying it in the form of Steam have been suggested.

By the sudden conversion of Steam into water, much caloric is extricated. Water, when heated, expands like other bodies: this is moderate till the temperature be 212°, when the expansion is prodigious; but the Steam, thus formed, does not acquire any higher temperature than 212°; the whole additional caloric is rendered latent, and is required for maintaining its gaseous state. In returning, therefore, to the fluid state, all this caloric again becomes free or sensible, and, by the law which regulates caloric, it must pass into

the surrounding bodies. It has been calculated that 1000° of caloric enter water to convert it into Steam and maintain it in that state: thence the whole of this must be given out in passing from the gaseous to the liquid state. The force with which the Steam is directed on the part much augments its vesicant effect. One difficulty, however, attends its application—that of limiting its action. Could it be applied by guarding every part around that which is to be blistered, by substances which do not rapidly absorb caloric, all the advantages of vesication would be procured. Gout in the stomach, spasm, acute inflammation of the heart and pleura costalis, and, in fact, every deep-seated pain, might be benefited by its employment.

f. HEATED METAL.—This method of blistering was proposed by Sir Anthony Carlisle. It consists in applying a piece of polished metal heated in boiling water: it possesses one advantage over blistering by steam—that its influence can be limited, and that it is altogether more manageable. Any piece of polished metal, not too large, and sufficiently thick to retain the heat for a few seconds, will answer the purpose.

C. SUBSTANCES WHICH OPERATE AS SUPPURATIVES.

* . *Organic Products.*

a. ACRID OIL.

This Acrid Oil is not employed in its separate state: in combination with other vegetable constituents, it forms the active principle of the following substances:

1. BULB OF THE WHITE LILY. *Lilii albi bulbus.*—The beautiful plant which bears this bulb, although a native of the East, is now naturalized to this climate, and forms one of the most splendid ornaments of our gardens. It belongs to the natural order Liliaceæ*. The bulb consits of thick, fleshy, imbricated scales, which contain, in combination with much mucilage and starch, an acrid, volatile oil, on which its suppurative properties depend. The bruised bulb, macerated in fixed oil or alcohol, yields up its oils to these vehicles, which,

* Woodville's Medical Botany, third ed. p. 743, pl. 254.

applied to the skin, bring out a crop of pustules. It is now very rarely used.

2. Inner bark of the Mezereon. *Mezerei Daphnis et Gnidii cortex.*—These two barks, under the name of garou, have been, for many years, employed in France for maintaining the discharge from issues. It is in common use with the peasants of the Pays d'Aunis, and was made known to the profession by Dr. Le Roy in 1767. The peasants, from whom Le Roy borrowed this mode of using the Daphné, employed it as a vesicant, applying the soaked bark on the sound skin, covering it with an ivy leaf, and renewing the application once in twenty-four hours. All the species of Daphne possess the same acrid inner bark, and are indiscriminately used for yielding the garou. It is prepared by soaking the branches in water and vinegar, raising the bark and separating the inner from the exterior layer. When dried and fit to be used, it has a fibrous texture, is of a pale green colour, has a faint, unpleasant odour, and a corrosive, acrid taste.

This acrid principle of the bark of Daphne is an alkaloid, which Vauquelin discovered, and which is known under the name of Daphnina.

The bark of the Mezereon has been employed as an Epispastic, from time immemorial, in some parts on the Continent. If a small portion of the prepared inner bark be soaked in vinegar and applied closely to the skin, it first reddens and inflames it, and, by repeating the application, a superficial suppurating sore or ulcer is slowly produced. It affects, however, the cuticle only, and does not form deep ulceration or positive wound, although the discharge be considerable: the redness is, in extent, limited by the size of the covering, whether this be an ivy leaf, or a portion of oiled silk which answers very well. Sometimes small phlegmons surround the ulcer thus made, and induce an almost insupportable itching; but this inconvenience is easily obviated by the application of a pledget of cold water over the part. A pommade or ointment of the expressed juice of the bark of the Daphne is also made for the purpose of dressing issues, and it is much preferable to the savine or any other ointment.

It has one great advantage in particular over the savine ointment—it may be kept for any length of time without losing its effects. I am astonished that it has not been introduced into the British Pharmacopœias.

3. SAVINE OINTMENT. *Ceratum Sabinæ.* L. D.—This ointment is prepared from the Juniperus Sabinæ. (See Emmenagogues.) It is a common agent for maintaining the discharge from blistered surfaces. The acrimony of the Savine depends on an acrid, volatile oil, which is much injured by boiling it with the lard, the usual mode of preparing the ointment: indeed, so delicate is this plant, as far as regards its acrimony, that even the powder of the dried leaves is much less active than the bruised fresh leaves. The powder is employed on the Continent as an escharotic for destroying excrescences and cicatrizing syphilitic ulcers; but, although these are the expressions of the French physicians, yet I cannot see any advantage that can result from the cicatrization of a venereal sore as long as the habit remains infected; and, when that ceases to be the case, the sore will heal without any difficulty. When the Savine Ointment is good and well prepared, it has a lively green colour and the peculiar odour of the fresh plant. During its employment for maintaining the discharge of issues, it is requisite to remove, once in three or four days, a whitish coating which forms on the surface of the sore, and which impedes the influence of the ointment when it is not removed.

b. OLEO-RESINS.

These operate as local excitants, causing deep-seated and most active phlegmonous inflammation, similar to those suppuratives which have been last noticed.

1. BURGUNDY PITCH. *Pix Abietina.* L. *Pix Burgundica.* E. D.—This is an exudation from the Spruce fir, Pinus *abies*, obtained by making incisions through the bark down to the wood. It flows thick and languidly, and concretes in flakes at the bottom of the incisions, adhering so firmly as to require to be separated by force. These flakes, after being melted by boiling in water, are strained through cloths. Burgundy Pitch, thus obtained, has a terebinthinate

taste and odour, is brittle, opaque, and of a light-fawn or reddish-yellow colour. It is softened by a moderate heat, and is very tenacious.

As a suppurative, the influence of Burgundy Pitch is slight; it produces a pimply eruption, which yields a purulent exudation, and causes much itching. Its chief excellence consists in its adhesiveness, which enables it to remain attached, and thus to maintain, for a considerable time, a moderately counterirritant effect. It has been found useful in chronic catarrh and dyspnœa.

Burgundy Pitch forms the bases of several compound suppurative plasters, the most useful and effective of which is the warm plaster, *Emplastrum calefaciens* of the Dublin Pharmacopœia, and which owes its greater activity to the addition of one part of plaster of cantharides to seven parts of the plaster of Burgundy Pitch. In some habits, it blisters; but, in these cases, this inconvenience is easily remedied by lessening the proportion of the blistering plaster. I have found it extremely serviceable in those cases of dyspepsia which are connected with a state of subacute inflammation of the stomach. On account of the cantharides which it contains, strangury sometimes follows its use; thence it is contra-indicated in cases of general excitement.

2. Compound Galbanum Plaster. *Emplastrum Galbani compositum*. L. *Emplastrum Galbani*. D. *Emplastrum Gummosum*. E.—All these plasters differ in their components; but all of them contain Galbanum, on the excitant influence of which their suppurative powers are supposed to depend. They do not produce the same pustular eruption as the Burgundy pitch plasters; but their influence seems to extend deeper, and to stimulate the larger superficial vessels. They are generally employed to accelerate the suppuration of indolent scrofulous tumours and tumours of an encysted kind, and also to impart action to the indurations which often remain around abscesses after they are discharged.

3. Ammoniacum. L. E. D.—This gum-resin, when dissolved in vinegar and the solution inspissated by heat, forms an excellent suppurative plaster, which does not produce pustules on the surface, but, like galbanum, stimulates deeply,

and consequently aids the suppurative process in indolent swellings. In many instances, instead of forwarding suppuration, it favours resolution: thence, in combination with mercury, it is successfully employed to discuss indurated glands, nodes, tophi, and indolent tumours.

* * *Inorganic Substances.*

c. ACIDS.—When the quantity of the mineral acids is combined with a greater quantity of lard than that which was mentioned under rubefacients, the mixture operates as a suppurative, causing successive crops of pustules to appear on the skin. They possess no particular advantages over other and more manageable Epispastics.

d. TARTAR EMETIC. *Tartras Antimonii et Potassæ.* L. E. D.—When a strong solution of Tartar Emetic, or an ointment containing it in the form of fine powder, or a plaster sprinkled over with its powder, is applied to the skin, a vivid inflammation gradually succeeds, and a thick crop of pustules rises upon the spot: these suppurate freely, and terminate in crusts, in a manner not unlike small-pox. In producing these effects, Tartar Emetic exerts no corroding influence on the cuticle; and consequently it is more or less effective according to the condition of the skin at the time of its application, and the mode of applying it. It has been judiciously recommended to excite the part before applying the Tartar Emetic, "either by friction with warm flannel, or a flesh brush, or by some stimulating application of a penetrating quality, such as camphorated spirit or strong vinegar." The sensibility of the skin being thus augmented, the Tartar Emetic, if immediately applied, instead of requiring two or three days to produce some large and scattered pustules, is often followed, in the course of a few hours, with a thick crop of pustules, differing in size according to the strength of the application. If the ointment be employed, the best proportions are two drachms of Tartar Emetic in fine powder, one drachm of lump sugar, also in powder, and six drachms of simple ointment. The manner in which the ointment is applied varies much its effect: thus, if the part be merely

smeared with it, little more than a rubefacient effect is produced; if slight friction for a few minutes be added in applying the ointment, distinct pustules will follow; and, if the friction be continued for fifteen or twenty minutes and be pretty brisk, the speedy formation of a full crop of confluent pustules will be the result. If, instead of using the ointment, a solution of Tartar Emetic be preferred, the skin should be first rubbed with a piece of flannel, and then the solution applied as hot as it can be borne. The pustules are thus rapidly produced, they are small and numerous, and speedily heal, leaving no traces behind them, so that this method of applying Tartar Emetic is peculiarly adapted for females. If the powder of the Tartar Emetic be sprinkled on the common wax plaster, the result is much less certain than either of the methods of using it just described. In some instances, no effect whatever is produced; whilst in others a severe ulcerated surface is exposed on removing the plaster; and the pain attending it is often more than sufficient to counteract the intention for which the suppuration has been applied, by the excitement which it induces.

By proper management of the ointment, a full pustular eruption may be almost always procured in five or six hours; and as its counter-irritant influence is equal to that of a blister, it is preferable to other suppuratives, in many cases of deep-seated inflammations. The manner in which Tartar Emetic produces this effect is not well understood; neither can any satisfactory reason be given for its not stimulating equally the whole of the surface to which it is applied. It has occurred to me that the cuticle may be partially abraded by the friction applied either before or at the same time as the ointment, and the extreme vessels be thus affected in spots. One argument against this opinion might be brought forward—that the application of the solution of Tartar Emetic, if sufficiently strong, produces the same effect. Even in this case, however, the preparation must be absorbed; and, when it affects the larger branches of the capillaries, there the pustules may chiefly appear. I offer this opinion, however, as a mere hypothesis.

The application of Tartar Emetic as a suppurative, although not invented by Dr. Jenner, yet was introduced to

the profession by that distinguished physician. It is now very generally employed as a counter-irritant in all deep-seated pains and inflammations; and particularly in pulmonary inflammation. It does not always readily produce its pustular effect on all skins; which may be accounted for, if my opinion be correct, from the greater density of the cuticle, in some persons, preventing absorption.

Suppurative inflammation, thus excited, is a more permanent mode of producing counterirritation than blistering by any means; and it may be employed with less hesitation than blistering, in as much as its absorption into the system, should it take place, will not prove stimulant. Some inconveniences are said to arise from the employment of Tartar Emetic as a suppurative—for instance, if it be taken into the habit, it produces sickness, particularly when applied to children. Dr. Griffith, an American physician, published a case, in which he states that the Tartar Emetic ointment caused salivation; and Dr. Jackson, another American physician, has met with similar instances. With regard to the power of the Tartar Emetic ointment to prodnce sickness, I cannot deny the possibility of the case; but, in a very extensive use of this ointment, I have never met with such results. Some inconvenience, and, if the habit of the patient be very irritable, even some danger, may result from continuing the application of this ointment after the pustules are fully formed. Ulceration takes place, and occasionally sloughing. If the application be continued after ulceration has supervened, symptoms resembling those that occur when arsenic is applied to an ulcer—coma, feeble pulse, and paralysis—are apt to shew themselves. It also occasionally causes an irritation, sometimes very severe, of the genital organs.

Tonelli, an Italian physician, formed an hypothesis that, independent of its irritant property, this ointment induces a specific effect on the lungs, owing to its abstraction of oxygen from the blood. It is unnecessary to make any comment on so visionary an opinion.

*** *Mechanical Means.*

e. ISSUES.—Any substance, calculated to cause mechanical

irritation when introduced into a wound, is sufficient to form an Issue. The wound may be made by the knife of the surgeon, or by the application of potassa fusa or nitrate of silver upon the skin: thence these are the means most frequently employed. In the application of Potassa, it is necessary to limit its effect by defending the adjacent parts by a piece of adhesive plaster with an aperture in it, over which the caustic is placed. When the eschar has separated, either the Curaçoa orange, Aurantium *Curassaventium*, or the common dried pea, or a small portion of mezereon bark, is the usual mechanical irritant introduced to maintain the discharge.

f. Setons.—The lançet-bladed needle, threaded with a skein of silk, or the bistoury of the surgeon, is the agent for forming Setons. A portion of the skin is pinched up, and the instrument passed through it. If a skein of silk be not used, a tape of caoutchouc, or a stripe of sheet lead may be introduced into the wound; and, by shifting these daily, and occasionally smearing them with a little resin or savine ointment, the wound is kept open and a discharge is induced. The inflammation, at first, is often so considerable as to require to be moderated by the application of a poultice.

Issues and Setons, by the inflammation which they cause, attract a large supply of blood to the surface; and, as they also constitute drains, they are well adapted for relieving deep-seated inflammations and inordinate determinations of blood to internal organs. They prove occasionally salutary in apoplexy, palsy, and similar affections; and, by their evacuant property, prevent injurious results from the drying up of old ulcers, or the repulsion of chronic cutaneous eruptions. On this account, Issues or Setons which have been long open should not be hastily dried up: they should be gradually diminished in size and depth, and, at the same time, a moderate contra-stimulant effect maintained by means of purgatives.

D. SUBSTANCES WHICH OPERATE AS ACTUAL CAUTERANTS.

Actual Cauterants comprehend all substances employed to cause disorganization of the part for the purposes of counter-

irritation. Many substances may be used with this intention; but I will confine myself to the two which are most frequently employed. I may preface my account of these with a few general remarks.

By the term actual cauterization, in contradistinction to potential cauterization, is meant the application of free caloric, in a very concentrated state, to a limited portion of the surface of the body. Potential Cauterants operate as chemical agents, destroying the life of the part by combining with its elements, and leaving a slough, which is, after some time, slowly thrown off from the body by the vital powers of the surrounding parts. The *Actual Cauterants* also form a a slough; but the action of the caloric is confined to a limited portion of the body, as far as its destructive influence is exerted; and, beyond that, its stimulant influence rapidly rouses the energy of the surrounding parts to throw off the eschar, instead of paralysing them, as is the case with the potential cautery: the sloughing, therefore, takes place much sooner than when the potential cautery is used. It is more beneficial than the potential cautery; and, were the application rendered less severe to the feelings of the patient, notwithstanding its formidable appearance, I am satisfied that it would be very generally adopted. The Actual Cauterants most frequently employed are—1. *Moxa:* 2. *the white-hot Iron.*

1. MOXA is a remedy of Chinese origin, and consists of small masses of combustible materials, which are burnt in contact with the skin, so as to form an eschar, more or less deep as circumstances may require. The Moxa employed by the Chinese is a cottony substance obtained from the leaves of a plant of the natural order Compositæ, the Artemisia *Sinensis*, a perennial under-shrub, a native of China and of Siberia. The leaves are about an inch long; the lower ones wedge-shaped and three-lobed, the superior lanceolate and obtuse, and all are tomentose. The flowers, which are borne on the summits of the twigs, are closely compacted in a simple roundish or ovate raceme; the calyx is lax and woolly. The plant is inodorous, and has a bitter, aromatic taste. For the purposes of preparing Moxa, it is cut in June,

early in the morning, when it is wet with dew, and is next hung up to dry for a long time, in the free air, in a shady place. The *Moxa* is prepared by beating the dried tops and leaves of the plant in a mortar, until they resemble coarse tow: they are then, in this state, rubbed between the hands till all the fibrous and membranous parts of the leaves and stalks are separated; and what remains resembles very fine cotton, which is rolled up in the form of little cones or pastiles. When they are to be used, they are placed upon the skin and lighted at the apex. The Artemisia *Indica* and A. *vulgaris* are also prepared in a similar manner and for the same purposes, in Japan and Java; and the Laplanders use a fungous plant which grows in the fissures of old birch trees.

As these *Moxas* cannot be readily procured in Europe, other materials have been employed for forming them, particularly by the French, who have used them more than almost any other nation. Baron Percy suggested to M. Robinet a method of forming them from the pith of the common Sunflower, Helianthus *annuus*, a substance which burns like touchwood; and the majority of the French Moxas are formed of a cylinder of this substance rolled in a piece of cotton. They are made of various sizes, according to the fancy of the surgeon who is to use them. Some are hollow cones, and burn more rapidly and intensely than the solid cones: they are, therefore, employed when a deeper eschar than usual is required. In this country, Moxas are most commonly formed of cotton which has been soaked in nitre; sometimes of lint or fine linen which has been soaked in a filtered solution of chlorate of potassa, as recommended by Mr. Wallace*.

When the Moxa is to be used in gout, it is placed over the seat of pain. If the disease be paralysis, it is applied first over the origin of the nerves which go to the diseased parts, and afterwards along the same nerves in different portions of their course. According to the size of the Moxa, the mode of using it, and the nature of the combustion, whether spontaneous or aided by the blow-pipe, it causes either little obvious injury of texture, or it produces vesica-

* Physiological Enquiry respecting the Action of Moxa, &c. &c.

tion, or it forms an eschar. Employed with the first intention, the Moxa is not placed on the skin, but held in the forceps as close to the affected part as the patient can bear, and moved closely backwards and forwards until the combustion be finished. To produce vesication, the Moxa is held steadily as close as possible to the skin without touching it, until the skin appear white, which is the indication of the cuticle being separated and a blister raised. Neither of these methods can, strictly speaking, be regarded as cauterizing; but I have preferred mentioning them in this place rather than under the heads Rubefacients and Vesicants, to which they properly belong. To form a superficial eschar, the Moxa is placed on the skin, and allowed to remain until the skin under it appear brown, which generally occurs before the Moxa has burnt completely down to the skin. It is only for forming the deep eschar that the combustion is allowed to be completed. The radiation of the heat, in this case, inflames the skin to some distance; and it is found red and wrinkled around a black spot produced by the combustion of the Moxa. The eschar thus formed is deep; but it does not rapidly separate, sometimes requiring a fortnight for that purpose. The ulcer which is formed discharges pus abundantly, and, by the aid of peas, may be converted into an issue. When the intensity of heat is wished to be increased, the blow-pipe is employed, and the Moxa surrounded by a cylinder of card-paper, which both prevents it from being blown away, and also directs the current of heat downwards. If the pain after the operation be so intense as to be very uncomfortable to the patient, a few drops of ammonia, or some oil of turpentine, or alcohol, or ether, applied to the part by means of a hollow tube, will almost instantly moderate it. Baron Larry recommends this application of ammonia for allaying the pain, and remarks that it prevents inflammation — "the very effect," says Mr. Wallace, "which those who do not understand the application of Moxa are desirous of producing!" This gentleman maintains that, in the employment of Moxa, it should ever be our object to prevent inflammatory action. He conceives that the modus operandi of the Moxa is not the production of inflammation, but the applica-

tion of a powerful stimulus to the capillary vessels, causing them to act with more force, to contract their diameters, and consequently to circulate their blood with more velocity, and, either by means of this action on the capillaries, or a direct action on the lymphatics of the part, to excite the functions of the absorbent vessels. He therefore concludes "that the action of Moxa on deep-seated disease is precisely similar to that which is exerted by some of our most valuable agents on superficial disease."

Be this as it may, it is difficult to conceive upon what grounds Mr. Wallace can maintain that Moxas, under at least three forms of their application, do not produce inflammation; for we cannot conceive the application of caloric to a part of the body, for a sufficient length of time or with a sufficient intensity to produce disorganization, without inflammation being the result. His hypothesis, however, explains the operation of Moxas when the texture of the skin is left undisturbed, by preventing the Moxa from touching the skin, and only moving it backwards and forwards over the part; but, when the disorganization of the skin is actually effected by the combustion of the Moxa, I cannot avoid referring its beneficial effects to the same law of counterirritation to which the operation of vesicants and other powerful Epispastics undoubtedly must be referred. The manner in which the caloric is communicated to the part in the burning of a Moxa causes it to penetrate deeply; thence it is well adapted to make an impression on deep-seated inflammation; but, on this account, they should not be applied on parts where there is cartilage, tendon, or bone, or near the surface.

2. White-hot Iron.—This application instantaneously destroys the life of the part, and forms an eschar, which is rapidly thrown off. It is regarded as a barbarous operation, and has never come into general use in this country, although this opinion is more imaginary than real; for, when it is properly applied, so as to prevent the radiation from inflaming, to a great extent, the surrounding skin, it even excites less pain than a moxa.

Three circumstances require attention for performing the

operation well and effectively:—1, the vicinity of the part to be cauterized should be covered; 2, the iron should be heated to whiteness; 3, it should be applied as quickly as possible, and pressed firmly upon the spot. With respect to the first rule, it is the radiation of the caloric from the white-hot iron which causes the pain attending its application, and which frequently produces vesication of the surrounding skin; the sound skin therefore should be guarded by being covered with folds of damp cartridge paper, having a hole cut in it large enough to admit the bulb of the iron to reach the skin. When this is done, little or no pain is experienced; the heat of the iron instantly destroying the vitality of the part to which it is applied. With respect to the second, the hotter the iron is, the sooner the life of the part is destroyed; and, with regard to the third, the only pain is in the approach of the hot iron, and therefore the quickness of the application must modify the pain.

The actual cautery was a remedy employed in the medicine of almost every rude nation of antiquity*; various substances being used as media for communicating the caloric; as, for example, iron, the burning nut of the olive, boiling oil, boiling water, burning sulphur, and melted lead: but the medium in most frequent use was the heated iron†. The Arabians employed it to relieve pains in any part of the body. The ancients applied it to strumous tumours, and also in cases of encysted tumours. Hippocrates recommends it in polypus of the nose and chronic pains of the head which cannot be relieved by bleeding. Hippocrates, in the sixth aphorism of his eighth book, says, "what medicine will not cure,

* The actual cautery appears to have been in use in England and Ireland in the thirteenth century; for we are informed that, after the defeat of Peter, Bishop of Winchester, the minister of Henry the Second, he took refuge in Ireland, whenee the Lord Justiees were ordered to send him "dead or alive" to England. "The compliant justices," says Sir James Maeintosh, "quickly caught the import of this alternative; and, after a long series of acts of falsehood and perfidy, caused him to be most cruelly murdered by a treacherous surgeon, who, being called to heal some of his old wounds, burnt or cauterized them so fiercely as to throw him into a raging fever, of which he died in great agony."

† Imbert Delonne, Nouvelles Considerations sur le Cautère Actual. Paris, 1812.

iron will cure, and what iron will not cure, fire will cure; but what cannot be cured by fire is incurable."

The salutary influence of the White-hot Iron is often experienced before it has time to operate as a counter-irritant; and yet it is not easy to conceive how it can act on any other principle. It undoubtedly produces a powerful effect on the nervous system, to which its sanative influence in spasmodic and convulsive affections may be attributed. In affections of the spine, and more especially of the spinal cord, I have seen more benefit derived from its use than from any other counter-irritant; and, in cases of fungous hæmatodes, the morbid growth may be kept at bay, and its progress checked by the repeated application of a small iron to the integuments over it. It has lately been more used than usual in this country for the destruction of malignant tumours. It is better adapted for plethoric than emaciated habits; for adults, than children.

THERAPEUTICAL USE OF EPISPASTICS.

In fevers of an intermittent character, blisters have been applied to disturb the regularity of the paroxysm, and thence to cure the disease. Were it easy to calculate the period at which a blister would produce its full operation, in every state of the habit, we might be induced to rely upon its influence for restoring the balance of the circulation, which is evidently deranged, in the cold stage of ague: this, however, cannot be done; and blisters are, therefore, seldom employed for the cure of intermittents. If the effect of the blister depend solely upon the local stimulus which it induces, then those substances, such as ammonia and boiling water or steam, which raise an instantaneous blister, might be advantageously employed; but, as I am inclined to think that more is to be attributed to the general excitement of the habit than to the local stimulus, blistering by cantharides is to be preferred; and this is too uncertain, in the acme of its action, to be relied upon in agues. If blisters be employed, they should be applied before the commencement of the paroxysm, that their influence may be fully felt, and the train of morbid associations, constituting the paroxysm, be broken at its commence-

ment. How much of the benefit is to be attributed to the pain of the blister arresting the attention of the patient, I cannot pretend to determine; but, as we know that intermittents are occasionally cured by the force of mental impressions, it is not unlikely that some part of the benefit is due to the painful sensation excited by the rising of the blister. Upon the whole, however, I am of opinion that, in the range of remedies adapted for checking the paroxysm of intermittents, blisters are the least to be relied upon.

The employment of blisters in continued fever has been advocated and condemned by different writers of equal celebrity. If they are applied with the view of arresting the progress of the fever, the expectation of the practitioner will be disappointed: indeed the irritation they produce is likely to increase the evil, if they be applied in the early stages of the disease, which are those of excitement. In the later stages of continued fever, however, when coma and delirium supervene, both sinapisms and other rubefacients, and blisters, may be employed with the fairest prospect of advantage. The delirium in fever is of two kinds: in one there is a preternatural or morbid determination of blood to the head; in the other there is that state which has been termed collapse, the pulse is weak, and the whole system debilitated. In both cases, blisters may prove beneficial: in the first case, they act as local stimulants, producing derivation or a transferrence of disease; in the other, they rouse the powers of the system by their general stimulant influence. When blisters are necessary for relieving coma, they should be applied to the shaved scalp: in very low states of the habit, however, rubefacients are to be preferred to blisters, as they are less likely to cause gangrene, and are nearly as beneficial in relieving local affections. In general, when rubefacients—for instance, mustard cataplasms—are employed in typhus mitior, they are applied to the feet—a relic of the old doctrine of revulsion; but, like other local means, their utility is in proportion to their vicinity to the part affected. This is particularly to be kept in remembrance in those affections of certain organs; such, for instance, as the lungs indicated by cough and oppressed breathing, which too frequently require the closest

attention of the physician towards the close of fevers. In all cases where the abstraction of blood is necessary, the application of a blister should be delayed until after the bleeding, when the excitement has been diminished.

If we regard particular kinds of continued fevers, we find that practitioners in tropical climates recommend, strongly, the application of blisters to the pit of the stomach in yellow fever, under the idea that the stomach is the chief seat of the disease, inducing a malignant gastritis. "A prompt application of a large blister over the region of this viscus," says Dr. Chapman, "is obviously indicated, and all experience confirms its utility." The salutary influence of blisters applied to the head in the delirium of typhus is undoubted in those cases in which there is danger of the inflammatory action terminating in effusion. When the breathing is affected, it is more useful to apply them along the course of the spine; and in this case they should be of dimensions sufficient to stretch from the third cervical to the first lumbar vertebra.

The best general rules for the application of blisters in continued fever are the following. 1. In that form of continued fever which is characterized by the early stages being inflammatory, they should be employed rather towards the conclusion than at the commencement of the disease: in typhus, on the contrary, rather at the beginning than at the close. 2. The evening is the best time for applying a blister, as it generally induces sleep when it begins to rise; and, were it applied during the day, the irritation which remains is likely to increase the evening exacerbation of the fever and prevent sleep. But, although these are the general rules, yet the practitioner must be guided by circumstances: thus, great determinations to particular parts and spasmodic affections require the use of blisters in the decline of the disease; whilst the same symptoms occurring in the commencement, being commonly connected with the general state of the system, are more effectually removed by general means.

In those symptomatic fevers in which there is a local inflammatory affection, the efficacy of blisters is undeniable. With regard to the proper time of applying them, as far as my own experience extends, I accord with those who think

that they ought not to be employed until the general excitement has been reduced by blood-letting and evacuants. At a proper period of the disease—that is, after the first or second bleeding—the application of a blister will often render farther venæsection unnecessary; and, certainly, when this can be effected, it is of the greatest importance, as the strength of the patient, which is rapidly reduced by repeated venæsections, is kept up, and the period of convalescence consequently shortened.

It was the custom of Huxham, and others prior to him, to apply blisters at a distance from the affected part—a practice founded on the theory of revulsion: but subsequent experience has demonstrated that they should be applied as near to the seat of pain as possible. When the inflammation is superficial, it is preferable not to apply the blister directly over the inflamed part, for two reasons—first, because local bleeding may be requisite after the blister has been applied, and therefore the affected part should be left free; and, secondly, because it has been ascertained that a large blister, applied at a small distance, has the same effect as a smaller one applied nearer to or directly upon the inflamed spot.

In phrenitis, the accompanying delirium rises to an exalted state: all stimulants become insupportable—light to the eyes, and sound to the ears. Tremors of the limbs, convulsions, coma, a sinking pulse, difficult deglutition and hiccup, occur, which are the forerunners of death. After the excitement has been reduced, it is usual to apply a blister over the shaved scalp. Now, although I would not attempt to impeach the propriety of this practice after due evacuation, yet it is necessary to repeat what I have already stated, that cantharides are not the proper vesicants in phrenitis. If a counter-irritant be requisite, a mustard cataplasm, applied over the shoulders, or a suppurative, such as the tartar emetic ointment, or the actual cautery, when it can be applied, on the nape of the neck, or on the biceps humeri, will be found more advantageous than blistering by cantharides. To use the words of Dr. Burrows, speaking of the use of the tartarized antimony in mania—"This application might judiciously supersede cantharides, since it produces all their good, and none of their bad effects."

In pneumonia, blisters are applied; and they are found not only to diminish the cough, pain, and difficulty of breathing, but, by a transferrence of the inflammatory action to the surface, to promote the expectoration. The period proper for the application of blisters in this disease must be carefully attended to: the hardness of the pulse should be decidedly reduced, as well as the force of the other symptoms, indicative of actual inflammation, diminished, before they can be safely applied. Physicians of equal celebrity have differed as to the precise time for their application. Thus, Sir John Pringle generally ordered a blister to be applied after the first bleeding; and this was also the practice of Cullen; but Heberden and later practitioners have regarded it more useful to delay the application of the blister until after a second, sometimes even a third bleeding.

At whatever period it is applied, the blister should be large, and placed exactly over the seat of pain. There is no necessity for allowing the blistering plaster to remain longer applied than is requisite for raising the blister. No benefit is procured by delaying its removal; and, if cantharides be employed, disadvantage arises from the absorption of the cantharidеn. The application of blisters in pneumonic affections may be repeated as long as the symptoms of the disease continue; but, when these are obstinate, and time is thus obtained, the action of suppuratives, such as tartarized antimony, is preferable to that of blistering.

Some individuals, owing to a peculiar state of habit or idiosyncracy, cannot support the action of blisters of cantharides under any circumstances: in these the nitrate of silver is an excellent vesicant; or sinapisms and other rubefacients may be used, taking care to prevent them from inducing that degree of inflammation which is followed by vesication. On these principles our practice, as far as regards the employment of blisters in inflammatory affections of the chest, the fauces, the stomach, the alimentary canal, the liver, and the great intestines—as, for instance, that attending dysentery—should be regulated.

In ophthalmia, blisters are advantageously used after topical blood-letting. They are usually applied either on the tem-

ples or behind the ears. In the chronic form of the disease, I know of no class of remedies so serviceable as issues in the nape of the neck, kept freely discharging until the inflammatory affection has completely subsided, and the eyes have remained apparently well for some weeks. Aristotle informs us that the physicians of his time cauterized those afflicted with ophthalmia on the temples. I feel strongly disposed to recommend cauterization behind the ears, or on the nape of the neck: for the radiation from the hot iron, when it is applied so near the eye as the temple, is, in my opinion, likely to injure that delicate organ.

In gout and rheumatism, the application of Epispastics, whether vesicants or rubefacients, is more problematical. "Blistering," Dr. Cullen remarks, "is a very effectual means of relieving and discussing a paroxysm of the gout, but has also frequently had the effect of rendering it retrocedent." I have little experience of the truth of this observation in gout, having scarcely ever ordered the application of Epispastics; but, in acute rheumatism, I have so frequently seen the most alarming translation of the inflammation to vital organs, that I cannot too strongly denounce their employment in this disease.

The use of Moxa was introduced into Europe as a local application in gout by the writings of Van Swieten; and to English practitioners more particularly by those of Sir William Temple, who had experienced the benefit of it in his own case. Free caloric, or the actual cautery, applied by the hot iron, was in common use among the Arabians for removing pains in various parts of the body. The Chinese, Japanese, and many Asiatic nations, also employed free caloric as a remedial agent; but the hot iron was never used among these people, if we credit Kœmpfer. It was with them that the use of Moxa originated; and, according to Kœmpfer, it was so freely employed that sometimes the whole course of the spine was excoriated. The inhabitants of Lapland and Sweden apply Moxas in all internal pains, without external inflammation. I confess my doubts are considerable as to the beneficial effects of Moxas in gout, notwithstanding the authority of Hippocrates, who ordered them

to be applied on the node of the joint of the finger. I have already stated my opinion, that there is nothing peculiar in the matter of the substance used as Moxa which can modify its action; and I should be cautious of the employment of free caloric in gout, however extricated, on the same principle which induces caution in the application of blisters. If Moxas, however, be at all advisable in gout, they should be employed according to the first method—that is, moving them over the pained part, at a certain distance from the skin, so as to exert their stimulant action only on the capillary vessels, and on the lymphatics of the inflamed part. There is no rule, however, without exceptions; and, in atonic gout, a blister, and even Moxas, suited to produce a slight eschar, instead of repelling the inflammatory part of the disease from the extremities, tends to fix it there; and, consequently, becomes not only highly serviceable, but even indispensably necessary. In the same manner, blisters are admirably adapted for aiding the cure of chronic rheumatism: and in sciatica, which so frequently resists every other remedy, Moxas have been found of the most decisive benefit. This is, indeed, the usual method of treating this form of rheumatism in many parts of the Continent, particularly in Russia. The Moxas, however, are required to be so often repeated, that I have been induced to apply the actual cautery, in some cases, and have found that it is followed by the most permanent relief. Dr. Paillard has used phosphorus instead of Moxa, both in chronic inflammation of the joints and in inflammation of the abdominal viscera. He places a piece, half the size of a small pea, on the skin, and applies a hot wire to it. It acts rapidly and effectually. Dr. Paillard has applied thirty at once on the ham in neuralgia.

From the effects of the absorption of the acrid principle of cantharides, on the bladder and urethra, we should, a priori, be disposed to avoid the employment of blisters, raised by their means, in nephritis, or inflammation of the kidneys; yet, experience has fully demonstrated that such fears are fallacious, and that blistering plasters of cantharides may be safely and efficaciously employed in this complaint. In strangury, indeed, the irritation seems to be confined to the blad-

der and the urethra: the kidney seems little susceptible of so delicate a stimulus, if I may be allowed the expression: it is only when the pelvis of that organ contains a calculus, or very coarse crystals of uric acid, that pain is felt in it. In one affection of the kidneys, that enlargement of the organ which is often the consequence of inflammation, Epispastics are of the utmost service. Upon the whole, blisters and other Epispastics are valuable remedies in the phlegmasiæ, with the exceptions which I have pointed out. It must be admitted, also, that symptoms in many cases may contraindicate their employment: it is in the discrimination of these that the skill of the practitioner is often strikingly and most advantageously displayed.

In eruptive fevers, blisters are less decidedly useful than in the phlegmasiæ. In distinct small-pox they are seldom required; and, except when local affections are present, nothing beneficial can be expected from them: on the contrary, when the excitement is high, they tend to increase the evil. It is after the commencement of the secondary fever that their aid may be required to recruit the strength and determine to the surface; and, when this is the case, or if local affections, such as cough, or pain in the right hypochondrium or the region of the liver, demand their application, they may be applied without any regard to the pustules with which the part is covered. One of the local affections which most unequivocally demand their employment is difficulty of breathing, arising from an unusual degree of swelling in the fauces, impeding deglutition. In such a case, a large blister, applied as near to the affected part as possible, is a remedy upon which the utmost confidence may be placed.

In confluent small pox, when there is a sinking of the pustules, and of the swelling of the face, without these symptoms being followed by swelling of the hands, some writers, particularly Dr. Brocklesby, have judiciously recommended the application of blisters to the wrists and fore arms; and the same practitioner recommends blistering the wrists, when the salivation which attends this form of the small pox suddenly ceases without any swelling of the hands supervening. On the contrary, when the swelling of the face and the neck is

excessive, applying sinapisms to the lower extremities often relieves it. In both forms of the disease, if convulsions appear during the eruptive fever, blisters are proper ; and if, during the eruption, the pulse become feeble, blisters are useful to assist the languid powers of the constitution. The symptoms, which in small pox most decidedly demand the employment of blisters, are great anxiety at the precordia, coma, and delirium: under such circumstances their use is unequivocally indicated, and they are employed with the greatest advantage.

In measles, blisters have been frequently applied to recall, as it were, the eruption, when it has suddenly disappeared; but it has been correctly remarked, that this depends on a state of the disease in which blisters cannot be beneficial. They are, however, of use in relieving the cough, and particularly when pain of the chest indicates the presence of local inflammation.

In erysipelas, when it assumes the malignant character, the advantage of blisters has been established by the testimony of the amplest experience ; and by many writers they have been recommended on the same principle in scarlet fever, when it assumes the typhoid type. I cannot affirm that my own experience has led me to place much confidence in their utility as a general stimulant in the low state of malignant scarlatina; although, as a topical application, when the throat is much affected, I have seen them successfully employed. In hæmorrhagic affections, which, at least in their active state, resemble the phlegmasiæ, blisters have been sometimes found useful, particularly in bleeding from the nose and in vomitings of blood. In the former they are to be applied to the nape of the neck, in the latter to the pit of the stomach ; but in both it is always requisite that blood-letting should precede the application of the blister.

In dysentery, and some other affections which consist of fever with augmented alvine excretions, the use of blisters is occasionally indicated. In leucorrhœa, the morbid augmentation of the natural mucous secretion of the vagina is much diminished by their employment ; and great advantage is derived from their application on the loins, over the pubis, and

on the groins. In gleet, nearly equal advantage has resulted from their employment—an effect which might be anticipated, from their known influence on the urinary organs.

In phthisis pulmonalis, few means are so powerful as blistering, or the application of counterirritants for relieving the cough and difficulty of breathing, and rendering the expectoration free. Vesication, indeed, has always been regarded as a remedy of general application in this complaint; the excitement, even at the commencement of phthisis, being seldom so great as to contraindicate their employment. It becomes, however, a question whether it is better to apply the plaster of cantharides, or nitrate of silver, or the tartar emetic ointment? I have had little experience of the effects of nitrate of silver; but what I have observed is altogether in its favour: the influence of the tartar emetic ointment is well known. Dr. Griffiths, an American, published a case in which it produced salivation; and Dr. Jackson, another American physician, met with a similar instance. If these statements can be relied upon, they confirm the opinion of its action upon the glandular system, which may arise from a partial absorption of the remedy; but, however this may be, its utility, as a counterirritant, in tubercular phthisis is undoubted. It has one important advantage over vesicants and issues—it does not produce any considerable diminution of the strength; a circumstance which should be never lost sight of in prescribing for the relief of this formidable disease.

In nervous diseases, Epispastics, in every form, have been generally employed. In apoplexy, it is customary, immediately after full bleeding, both general and local, to apply blisters on or as near the head as possible. Cullen supposed that their utility depends "on their taking off the hæmorrhagic tendency" within the head: I would say that, after blood-letting has removed the impulse of the blood from the arteries of the brain, and this has also been aided by purging, blisters contribute to restore the healthy state of the circulation in that important organ. In applying blisters, or employing other Epispastics with this view, I have found them more beneficial when applied to the nape of the neck than upon the head; and the choice of this place is farther

useful by leaving the scalp free for the application of evaporating lotions; or, what is still more suddenly beneficial, the pouring a stream of cold water upon the vertex while the patient is in a sitting posture. When the patient is old and feeble, and the strength cannot be relied upon under much venæsection, the use of blisters may occasionally preclude the necessity of a repetition of the blood-letting. In that description of paralysis which Dr. Abercromby has so ably described as connected with a state of the brain, not apoplectic but *inflammatory*, the discharge produced by vesicants and issues is likely to prove more beneficial than in the ordinary apoplectic cases, in which an immediate and powerful counter-irritant is required.

In dyspeptic affections, blisters are seldom resorted to; but, in my own practice, I have found both blisters and other Epispastics of the utmost benefit. The application of the emplastrum calefaciens, containing rather more cantharides than usual, or the tartar emetic ointment, is preferable to the ordinary blistering plaster for such cases; and I usually order them to be applied, after the abstraction of blood from the pit of the stomach, directly over the organ, a little towards the left side, so as to confine their operation as much as possible to the fundus of the stomach. I am of opinion that the cause of the acescent state of the contents of the stomach in dyspepsia is the hasty and consequently imperfect secretion of the gastric juice, owing to the very irritable state of the viscus. Now, alkaline remedies, administered to correct the acescent state of the stomach which always attends this complaint, do not benefit solely by their chemical union with the free acid in the stomach: it is necessary, therefore, that the dose should be sufficiently large not only to neutralize the free acid, but also to leave uncombined a portion to act upon the irritability of the coats of the stomach, and, by diminishing this, to obtain a better gastric juice, more slowly and naturally secreted. That alkalies operate in this manner I was led to believe from knowing that, in irritable states of the urethra, in which a bougie cannot be carried on the bladder, on account of the spasm induced by its passing into the irritable canal, we can, almost always, instantly effect our

purpose by dipping the point of the bougie in a little liquor potassæ. It is upon this principle also that hydrocyanic acid produces its beneficial results in dyspepsia. To aid the operation of these internal remedies, an active warm plaster, applied over the pit of the stomach, after topical bleeding by cupping, proves most salutary. As soon as the pustules are fairly formed by this plaster, which occurs within forty hours after its application, the flatulence and acidity are found to be much abated; and, by continuing the application, and at the same time persisting in the use of the internal remedies, and regulating the operation of the bowels, yet carefully avoiding purging, the disease yields more readily than to any other means. In this case, the Epispastic operates entirely by the counter-irritation which it induces overcoming, by its extent and degree, the irritation of the stomach.

In spasmodic affections blisters are more or less employed. In tetanus they have generally been regarded hurtful; but, if the view of the pathology of this affection, which I have been led to take from a close observation of its symptoms, be correct, I am satisfied that, although blisters from the action of cantharides may prove prejudicial, yet, Epispastics of another kind are the remedies most to be relied upon for relieving tetanus. When we consider that many of the leading symptoms of this affection closely resemble those of hydrophobia; that the respiratory muscles are equally affected; and that the most distressing symptom is the spasm which affects the diaphragm and mediastinum, occasioning the violent pain always felt at the lower point of the sternum, before the general rigidity and spasms occur—there is every reason for thinking that the motor tract of the spinal marrow is the principal seat of the diseased irritation. In hydrophobia, I am of opinion that the opposite column, or that giving off the nerves of sensation, is the part affected. Now, if this opinion be correct—and post-mortem examinations of the spinal marrow, both in tetanus and in hydrophobia, confirm the opinion—it must be obvious enough that a powerful counter-irritant on the surface, along the course of the spine, will afford the most rational prospect of success in any attempt to cure this disease. Dr. Chapman mentions a case of tetanus which oc-

curred nearly half a century since, in the hands of a West Indian surgeon, a Mr. Carter, which was effectually cured by the application of a strip of blistering plaster along the whole extent of the vertebral column; "and," Dr. Chapman adds, "this practice, I have heard, has been recently imitated, and with sufficient success to claim our attention." I may also quote Celsus in support of this practice: he says, speaking of the treatment of tetanus, when it is not relieved by cupping on the neck, "eadem aut ferramentis aut sinapi adurenda." In a very severe case of tetanus, I acted upon this theory, and applied dry cupping several times a day, along the course of the spine, in conjunction with other means, calomel, purging, and opium, and succeeded in restoring my patient to health. This is one of the cases, in my opinion, in which moxas and white-hot iron would prove highly beneficial, if applied sufficiently extensively along the spine. How far the same practice might prove useful in hydrophobia, I will not pretend to determine: the excessive sensibility of the skin, in this formidable and hitherto uncured disease, would make me pause before applying moxas; but, if the radiation from the hot iron be properly guarded against by the method I have proposed, there is much reason for thinking that a salutary effect would result from its employment. In all cases of spasm depending on or connected with internal irritation, which is not of a mere mechanical nature, Epispastics in some form are likely to prove useful adjuncts, if they cannot be regarded as the principal remedies.

I have already noticed the impropriety of employing blisters formed of cantharides in mania; but moxas have been used beneficially in this disease. The ancients were in the habit of applying the actual cautery, as we learn from Celsus, who says, in treating of disorders of the head, "candentibus ferramentis, ubi dolor est, ulcera excitare;" and Reverius states that he cured mania by applying the hot iron to the coronal suture—a practice, however, which it is hazardous to follow. Suppuratives—as, for instance, the tartar emetic ointment—have been used to cause a derivation from the meninges of the brain to the surface; and, if we reflect upon the effect of the retrocession of cutaneous eruptions and their

reappearance during cerebral diseases, we can readily imagine that the artificial formation of a crop of pustules upon the scalp will be likely to be followed by the best effects. In eighteen cases treated in this manner by Dr. Jenner, five were of insanity, and three of hypochondriasis closely approaching to it: of these, three recovered their intellects in a few days. Dr. Burrows states that his practice with the same suppurative has not been so successful. In one case, however, when the habit was reduced to so low a state that there was an appearance of mortification of the extremities, a warm plaster, intermixed with tartarized antimony, was placed over the shaved scalp. The patient soon recovered, without the extremities sloughing. Dr. Burrows speaks less favourably of setons and issues, and remarks that it is probable "that, where they have been reported to have effected a cure, the malady has originated in metastasis, by the retrocession of some cutaneous eruption." "Whenever any of these causes," he adds, "are suspected of having influenced the mental disorder, a seton or issue should be introduced as near the head as convenient." He further adds, "Long-established setons and issues hastily dried up have caused many cerebral affections, and insanity among them."

It only remains to mention a few of the local diseases in which Epispastics, particularly free caloric, have proved useful: these are strumous tumours, bronchocele, buboes, mammary swellings, and enlargement of the testicles. Applied behind the ears, they are useful in deafness, in painful inflammations of the membranous linings of the ear, and in toothache. In acute and chronic inflammation of the joints, their decisive utility has been well established, and not less so in inflamed veins. The importance, also, of the actual cautery, although it is very rarely employed, in fungus hæmatodes, or soft, bleeding cancer, is undoubted. A watchman, who had been a soldier, applied for my advice respecting a cauliflower fungus which had protruded under the lower edge of the right pectoralis major. It had been, six months before, extirpated by the knife at Chatham Military Hospital; but the hæmorrhage was so excessive that he nearly sunk under the operation, and soon afterwards he was discharged as incur-

able. On examination, I discovered that the tumour descended from the clavicle between the two pectoral muscles, and only penetrated the integuments below the major. There was also a moveable tumour in the axilla, which I removed. The white-hot iron was then applied to the whole surface of the tumour, which sloughed off; and in a short time the integuments healed over the part, and the man seemed completely recovered. In three months afterwards, however, a small tumour pushed up the muscle and integuments about two inches under the clavicle: the cautery was applied, and it disappeared: it again successively appeared, and was as often removed by the cautery: but the patient, having been told that he could be cured by milder means, neglected to come to the Dispensary (the Chelsea and Brompton), the tumour again enlarged to its utmost extent, and he died. On examining the body, no internal organ appeared affected; there was merely a small warty tumour on the pleura costalis.

Upon the whole, few remedies are of more importance or of more general use in the cure of diseases than Epispastics. Much judgment, however, is required in determining the circumstances of the habit, the period of the disease, and the situation in which they ought to be applied.

PART IV.

SECOND DIVISION.—CHEMICAL AGENTS.

Under the term *Chemical Agents* are comprehended those substances which influence the body or its contents by their chemical properties. In prefacing our examination of these, this question presents itself—What is the nature of chemical action? It may be defined—that action which is regulated by certain laws operating upon the ultimate particles of matter, and leading to the transmutation of bodies from one state to another; which phenomena depend on the attractions and repulsions exerted between these particles. The combinations which are the results of such affinities are constant and invariable, and may be predicted with certainty when the elements are placed under the same circumstances. Thus, if I combine 54 parts or one equivalent of nitric acid and 47.15 or one equivalent of potassa, I can confidently predicate that nitrate of potassa will be the result; or, if I mix chlorine with sulphuretted hydrogen gas, that muriatic acid will be formed and sulphur deposited. But, when chemical agents are brought under the influence of the living principle, the affinities which produce these results are either modified or altogether resisted. Substances come into contact in the living animal system without undergoing any change, which, the moment life ceases, yield to the ordinary laws of chemical action, and decompositions and recombinations take place, which could not have occurred during the existence of vitality. Some substances, nevertheless, have so powerful an affinity for the components of animal matter as to overcome the resisting influence of the vital principle and effect new combinations with them. Others influence the body in a less direct manner by uniting chemically with substances which are acting morbidly upon the nervous system and changing

healthy into diseased action. By their chemical union with these morbid matters, they form new compounds which are either less active or which operate as sanitary agents. These are the substances comprehended under the term *Chemical Agents*. They exert their influence in three ways:—first, they affect the body directly and form new compounds with the constituents of its tissues; secondly, they affect it indirectly, combining, not with its organized tissues, but with the contents of the stomach, changing the properties of these; thirdly, they combine with and neutralize matters contained in the atmosphere, which might, if left unaltered, produce injurious effects upon the animal frame. Chemical Agents, therefore, in reference to their operation on the living system, may be divided into those which *act on the surface*; those which *act on the contents of cavities*; and *those which change the state of the air*: the first comprehending *Escharotics*; the second *Antacids*, *Antalkalies*, and *Antilithics*; the third, *Disinfectants*, or *Antiseptics*.

SECTION I.

CHEMICAL AGENTS WHICH ACT ON THE SURFACE OF THE BODY.

ESCHAROTICS.—MEDICAMENTA ESCHAROTICA*.

Syn.—*Erodentia.*

Escharotics are "Substances which destroy the vitality of the part to which they are applied, and erode or decompose the animal solid." In effecting this, they generally combine chemically with the animal matter, destroying its organization and forming with it a soft pulp or species of eschar; or, if they do not directly combine with the animal matter, they break the old affinites, causing the elements of the solid to enter into new combinations; whence, as Dr. Murray remarks, their cohesion is subverted and their composition is

* From ἐσχάρα, an *eschar*.

changed. In whatever manner this is effected, the life of the part is destroyed. The principal difference between the substances arranged under this order of remedies is in the intensity of their action. Those which operate most powerfully, destroying the life of the part, under all circumstances, may be arranged under the head *Cauterants*; those which act with less energy, and are chiefly employed to destroy diseased and fungous growths, under that of *Erodents*. Both may be employed with the same object in view, as far as regards their power of generally affecting the habit, as counter-irritants; but it is the first only, the *potential Cauteries*, that are usually preferred for this purpose; the second are generally employed to effect the destruction of fungous growths.

TABLE OF ESCHAROTICS.

A. SUBSTANCES WHICH OPERATE AS POTENTIAL CAUTERIES.

a.—Mineral Acids *(Oxygen with simple radicals.)*

Sulphuric Acid.	*Acidum Sulphuricum.*
Nitric Acid.	*Acidum Nitricum.*
Arsenious Acid.	*Acidum Arsenosum.*

b.—Alkalies *(Oxygen with metallic bases.)*

Potassa.	*Potassa.*
Lime.	*Calx.*
Potassa with Lime.	*Potassa cum Calcè.*

c.—Metallic Salts.

Nitrate of Silver,	*Argenti Nitras.*
Muriate of Antimony.	*Antimonii Murias.*

B. SUBSTANCES WHICH OPERATE AS ERODENTS.

* *Organic Products.*

a.—Acetic Acid.	*Aceticum acidum.*
b.—Refined Sugar.	*Saccharum album.*

*** Inorganic Substances.*

c.—SALTS.

Burnt Alum	*Alumen exsiccatum.*
Sulphate of Copper.	*Cupri Sulphas.*
Nitrate of Silver.	*Argenti Nitras.*

A. POTENTIAL CAUTERIES.

a. MINERAL ACIDS.

All the mineral acids, in a concentrated state, char and dissolve dead animal matter. This partly depends on their attraction for some of the components of the animal fibre; partly for the partial decomposition of the acid itself—the animal fibre having a greater attraction for oxygen than the bases of some of these acids; thence the animal tissues are oxidized and acquire new properties, forming compounds which are dissolved in the undecomposed portion of the acid.

1. SULPHURIC ACID. *Acidum Sulphuricum.* L. E. D.—This acid has a most powerful affinity for water, and chars, very rapidly, dead animal matter which is brought in contact with it, decomposing it, and itself also undergoing decomposition. When the strong acid is applied to the living body, the vital energy is not sufficient to resist its powerful attraction for moisture, and a soapy feeling is first experienced; but, in a very short time, as soon as the cuticle is dissolved, and the acid begins to act on the nerves, acute pain is experienced, the life of the part is destroyed, and it becomes charred in the same manner as dead animal matter. As far as the action of the acid extends, until it become greatly diluted by distance from the point of application, this change in the structure of the part takes place; but there is no definite limit between the dead and the living parts, as when the actual cautery is employed: an intermediate space exists, on which the action of the acid has not been sufficient to destroy vitality, but, nevertheless, has greatly weakened it; and thence a long period elapses before the slough is thrown off. This is one of the disadvantages of employing Sulphuric Acid as an

Escharotic; but greater inconvenience arises from its fluidity, and the impossibility of limiting its action to a particular spot. In consequence of these disadvantages attending its action, Sulphuric Acid is very seldom employed for the purpose of establishing an issue; but it is sometimes used for touching the surface of ulcers that have taken on an unhealthy action, with the view of inducing a change, and bringing back the ulcerated surface to the condition of a healthy, simple sore.

2. NITRIC ACID. *Acidum Nitricum.*—This acid acts with more energy than the sulphuric on the dead animal fibre; it decomposes it rapidly, and is itself decomposed; nitric oxide and nitrous acid vapours being freely disengaged.* Applied to the living surface, it quickly destroys vitality; but the sphere of its action is less extensive than even that of sulphuric acid; probably, in some degree, owing to its having less affinity for water than the sulphuric acid. It is never applied as an Escharotic to form an issue; but it has been advantageously employed, with reference to its escharotic effect, in sloughing, phagedenic ulcers. When it is to be used, the surface of the ulcer must be well cleaned and dried; and, after applying a thick coating of lard to protect the surrounding sound skin, the whole surface of the sore must be touched with the acid by means of a sponge, moistened with it, and pressed firmly down on every part: in the course of a few hours the sloughs which are formed are thrown off and the sore assumes a more healthy aspect.

3. ARSENIOUS ACID. *Acidum Arsenosum.*—This Acid, White Arsenic, has been more employed as an Escharotic than either of the two mineral acids which we have just noticed. It was first introduced into use for the cure of cancer, and various curious methods were adopted to obtund the violence of its action. Thus, Bayle recommends that it should be dulcified, as he terms the process of rendering it milder, by boiling alcohol over it several times. It was also applied mixed with sulphur and the powdered leaves of meadow

* When equal weights of muscle and nitric acid are heated together till the fluid boils, nitrogen and carbonic acid are evolved in a gaseous state, and the muscular fibre is partially converted into a fatty matter: and if skin, instead of muscular fibre, be employed, it is converted into fat and oxalic acid, whilst nitrogen and hydrocyanic acid are given over in a gaseous state.

crowfoot, the Ranunculus *acris*, and dog's fennel, formed into a paste with yolk of egg, which was spread over the surface of the cancerous sore, and covered with a piece of bladder; in twenty-four hours a slough formed, and the coverings being removed and the part poulticed, this was thrown off, and suppuration promoted. It has also been applied as an Escharotic in the form of ointment and solution. In the latter form it has been frequently employed, in the proportion of ten grains to an ounce of water; which is not, correctly speaking, a solution, but rather a mixture of the minutely divided acid in water. This is applied to the surface of the sore by means of a pencil. In treating of Arsenic as a tonic, the hazard arising from its application to the surface of a sore was hinted: it is as dangerous as when it is taken into the stomach; vomiting and violent purging being induced, and fatal consequences resulting. When death has ensued, the stomach and intestines have been found extensively inflamed, demonstrating the absorption of the Arsenious Acid into the system and its peculiar determination to these viscera. Such facts are sufficient to demonstrate the impropriety of rashly applying Arsenious Acid to external wounds; and, when it is employed, the necessity for watching very closely its effects. It at all times causes violent, lancinating pains; so that no external indication of its injurious effects is afforded by that means. The moment it produces any nausea, or affects the breathing, then the external employment of it should be suspended. Notwithstanding these effects, occasionally recurring, Arsenic has been advantageously employed as an Escharotic in scirrhus and cancer. It destroys the diseased surface, and, after the sloughs are thrown off, changes the morbid action of the vessels of the part, causing them to secrete a healthy pus, and thereby promoting the healing of the wound. If poisonous effects are produced by it, the same plan of treatment must be adapted as if the remedy had been swallowed by the mouth.

b. ALKALIES.

The Alkalies are much more frequently employed as Escharotics than the Acids.

1. Potassa. *Potassa.*—This substance is a hydrated oxide of Potassium, or a compound of Potassa and water, one equivalent of the Potassa retaining one equivalent of water. It generally, however, contains a small portion of the peroxide. When pure hydrate of Potassa is fused in a silver or clear iron vessel, at a heat rather below redness, and is run into cylindrical moulds, it assumes somewhat of a crystalline character on cooling, and constitutes the *Potassa fusa* of the London and Edinburgh Pharmacopœias, the old *Lapis causticus.* When Potassa is rubbed up with dead animal matter, it immediately decomposes it; and a saponaceous compound is the result, whilst the alkali becomes a carbonate. On this account, Potassa was early employed to destroy fungous excrescences on the living body. It is said to be more capable of dissolving the animal solids than pure soda, and is therefore preferred to it for forming eschars for issues. It operates chemically by its powerful attraction for water, and its solvent property over albumen and gluten, forming with them new compounds, which in fact constitute the eschar. It is best applied beat into a paste, with crumb of bread, the skin where it is not intended to act being previously guarded by two or three folds of adhesive plaster. Its first effect is the partial deliquescence of the alkali, which next powerfully stimulates the sensibility of the part, exciting the most excruciating pain, until the vitality of the spot be destroyed. It has one disadvantage depending on its deliquescent property—that, even when the adjoining parts are protected, it forms an irregular ulcer, and the eschar is very long of being detached. On the other hand, its action in point of violence can be easily controuled, by moistening the part with vinegar or any diluted acid when we wish to arrest its progress. Potassa was formerly much more employed as an Escharotic than at this time, both for keeping down fungous growths, opening abcesses, and forming issues.

3. Lime. *Calx.* L. E. D.—This hydrate of the oxide of Calcium acts nearly in the same manner and with equal energy as the Potassa, destroying quickly the vitality of the part and entering into chemical union with the animal matter of the spot to which it is applied. It operates chiefly by

withdrawing the water which forms a component part of all animal tissues. Although it is less apt to spread and extend irregularly its sphere of action than the potassa, yet it is much less employed, except as an addition to the potassa, in the Potassa cum calce of the Pharmacopœias. The effect of Lime in dissolving animal matter is so well known, that it has been used, from time immemorial, in dissolving the hair and gelatinous matter on skins, to fit them for receiving the action of tannin in the preparation of leather. As an Escharotic, it has the disadvantage of producing more pain and general excitement than the pure alkalies: it has been sometimes accidentally employed, and has not been productive of any bad effects.

c. METALLIC SALTS.

1. NITRATE OF SILVER. *Argenti Nitras.* L. E. D.—In its fused state, this is the common caustic used by surgeons, both for taking down fungous growths and often for making issues; but it is less adapted for the latter than pure potassa, as its sphere of action is extremely limited. It is admirably adapted for giving new action to languid ulcers; and has been lately used with great advantage for the cicatrization of ulcers.

All animal fluids, with the exception of gelatin, decompose Nitrate of Silver; and the oxide combines with the animal matter so as to form a crust, or rather coating, over the denuded surface, under which the cicatrization proceeds; after which the coating peels off, and leaves the part entire.

2. MURIATE OF ANTIMONY. *Antimonii Murias.*—This is a powerful Escharotic. It is prepared most effectually and quickly by the immediate combination of its constituents, metallic antimony and chlorine. It may also be prepared by mixing metallic antimony with two and a half times its weight of bichloride of mercury, and distilling: the chloride comes over and is condensed in the receiver, and metallic mercury remains in the retort. But the process usually adopted is the following, proposed by Göttling. Introduce into a retort a mixture of four ounces of vitreous oxide or glass of antimony in powder, sixteen ounces of muriate of soda, and twelve

ounces of sulphuric acid, diluted with eight fluid ounces of water; then lute on a tubulated receiver, and distil it to dryness, with a sand heat gradually increased: twenty ounces of Muriate of Antimony are thus obtained.

Muriate of Antimony is a soft, semitransparent, yellowish-white substance, volatile at a moderate heat, very deliquescent, and readily decomposed by water, which converts it into a submuriate, which crystallizes in white acicular crystals, and a soluble permuriate. The constituents of the muriate are 1 prop. of Antimony $= 64.6$, $+ 2\frac{1}{2}$ prop. of Chlorine $= 88.62$, making the equivalent 153.22. From its consistence, it is generally called Butter of Antimony, and assumes a crystalline form on cooling. Its deliquescent character renders it a very unmanageable Escharotic: it is, therefore, seldom used.

B. ERODENTS.

These, as the name implies, eat away, as it were, extraneous growths, and are, therefore, employed for removing fungous granulations and for destroying warts and other excrescences of a similar description. They operate by their chemical properties, and form new substances with the matter of the parts which they remove. Their action, however, is much less perceptible than that of the potential cauteries.

a. ACETIC ACID. *Aceticum Acidum.* L. E. D.—This acid, in its concentrated state, inflames and vesicates the sound skin. It consists of one proportional of dry acid and one of water, when it is in the state of the highest concentration in which it has been yet procured. In a much weaker state, at 1.074 specific gravity, it instantaneously produces a blister. When still more diluted, it operates efficaciously as an Erodent in removing warts and corns; but great care must be taken to prevent it from acting upon the sound skin.

The theory of the operation of this vegetable acid is the same as that of the mineral acids: it enters into chemical combination with the dead animal matter which forms the eschar*.

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* It was formerly imagined that Erodents, as well as potential cauteries, operated by means of sharp particles, which entered into the parts to which they were applied, and destroyed them.

b. Refined Sugar. *Saccharum purissimum.* L. E. D. —Sprinkled upon spongy irregular granulations, white Sugar operates as an Erodent; but there are so many better Erodents, that it is seldom employed for this purpose.

c. SALTS.

1. Alum. *Bisulphas Aluminis et Potassæ. Alumen.* L. E. D.—Alum does not display escharotic properties until it has been deprived of the water of crystallization, and has become the *Alumen exsiccatum* of the Pharmacopœias. It is not improbable that, in this state of Alum, some part of its escharotic influence is to be attributed to its action in attracting the moisture of the animal tissue, and favouring the coagulation of the albumen. It is not much used; nor would it answer for forming an issue; but it is well adapted for destroying granulations and for giving a salutary impulse to languid and irritable ulcers.

2. Sulphate of Copper. *Cupri Sulphas.* L. E. D.—This salt operates as an astringent on dead animal matter, and as an Erodent on the living body. It is more employed, however, as a powerful stimulant in giving energy to flabby, languid ulcers than as an Erodent in the strict acceptation of the word.

3. Nitrate of Silver. *Argenti Nitras.*—The influence of this preparation, as a potential cautery, has already been noticed: in a diminished degree of strength, or by applying it in a slighter manner, it acts as an excellent Erodent. The use of the Nitrate has been very greatly extended lately by the experiments and observations of Mr. Higginbotham of Nottingham. This gentleman found, that, when the Nitrate of Silver is applied to a wound or ulcer, extending the application to a certain length beyond the edges of the sore over the sound skin, it aids the rapid cicatrization of the sore. He has also applied it in phlegmonous, erysipelous inflammation of the absorbents, and many other similar affections. In these cases, it is probable that much of the benefit may depend on the formation, as he terms it, of the *adherent eschar*, or pellicle, which it forms of the cuticle or surface on which it acts. In ulcerations there can be no doubt of the

benefit likely to result from the formation of an artificial covering of the nature of this pellicle in protecting the irritable sore from the action of the air; and, by the gentle stimulus afforded to the vessels of the part, a more healthy action is promoted, and the cicatrization is thus promoted.

All the Escharotics operate by their chemical influence in destroying the vitality of the part to which they are applied: but they have also a counterirritant influence. The precautions requisite in using them refer—

1. To the chance of absorption; which, for example, may occur with arsenious acid, this being, under certain circumstances, poisonous when applied to ulcers.

2. To the nature of the places on which they are to be applied, as it is absolutely necessary to avoid nerves, tendons, and the larger blood-vessels.

The older physicians employed the Potential Cautery and Erodents very freely as counterirritants: Aetius extols their efficacy in asthma; Boerhaave and many others laud them in dropsies: it may indeed be said, generally, that they prove useful in all affections in which counterirritation is indicated, and where an immediate impression is not demanded. As a local Erodent, Boerhaave ordered the Potential Cautery in scirrhous glands—a practice which Heister properly condemns; and which is not devoid of danger when the arsenious acid is employed. With more propriety, Etmuller advised the Potential Cautery for removing polypi of the nose: but modern surgeons generally use the forceps for separating these parasitic tumours.

SECTION II.

ANTACIDS.—MEDICAMENTA ANTACIDA.

THESE require a very brief consideration. They are medicines which are said to obviate acidity in the stomach, by combining with superabundant acid formed there, and neutralizing it. In this chemical point of view, they can be

regarded as palliatives only, carrying off the acid already formed, but not preventing the formation of more: their utility, however, is not confined to their chemical action. I have had several opportunities of mentioning my opinions respecting the beneficial effects of alkaline substances in allaying the irritability of the stomach; and it is to this influence of Antacids that we are to ascribe much of the benefit derived from their employment in acidity of the primæ viæ.

The beneficial influence of Antacids is not confined to their action on the stomach. The generation of much acid in that organ indicates a general diminished state of tone, with augmented irritability and a condition of the system under which the formation of renal calculi is favoured, and gout shews itself: by allaying this state, Antacids may be regarded as remedies of general influence, not only in these diseases, but in many others connected with an irritable and a dyspeptic condition of the stomach. The greater number of them are carried into the circulation, and it is consequently difficult to decide whether the beneficial influence, which they evidently exert, is to be ascribed to their chemical properties, or to their excitant influence on the glandular and capillary systems.

TABLE OF ANTACIDS.

a.—Hydrates of Oxides.

Lime Water.	*Calcis Aqua.*
Magnesia.	*Magnesia.*
Potassa.	*Potassa.*

b.—Salts.

Carbonate of Soda.	*Sodæ Carbonas.*
Carbonate of Potassa.	*Potassæ Carbonas.*
Solution of Ammonia.	*Ammoniæ Liquor.*
Carbonate of Ammonia.	*Ammoniæ Carbonas.*
Carbonate of Magnesia.	*Magnesiæ Carbonas.*
Chalk.	*Calcis Carbonas.*

A. SUBSTANCES WHICH OPERATE AS ANTACIDS.

a. HYDRATES OF OXIDES.

1. Lime Water. *Calcis Aqua.* L. E. D.—This is an aqueous solution of Lime, the oxide of calcium. In the direction of the London and Dublin Colleges for preparing it, boiling water is ordered to be employed; and the whole of the water to be poured upon the Lime at once: both of these parts of the process are improper. In the directions of the Edinburgh College, the Lime is properly ordered to be first slacked by sprinkling over it a small quantity of water, which converts it into an hydrate, which is afterwards partially dissolved in the water poured over it, one grain only being taken up by 778 grains of the water. When a large quantity of hot water is poured over Lime, it does not quench well, owing to its forming a paste, which defends the interior from the action of the water: this fluid also, at 212°, requires 1270 parts to dissolve one grain of hydrate of Lime, whereas at 60°, only 778 grains are required. If it be not used immediately after it is made, it ought to be kept in well-stopped bottles, to protect it from the air, which affords it carbonic acid, and converts the lime into an insoluble carbonate.

When lime-water is employed as an Antacid, if we were to rely merely on its neutralizing property, the quantity required would be much greater than could be conveniently administered. It is said, by Dr. Murray, to restore the tone of the stomach and to operate also as an astringent; but, although it corrugates the muscular fibre, and on that account is regarded as astringent and tonic, yet, neither of these properties is very obvious in lime water; and, therefore, we must refer the benefit it produces in cases of acidity to its alkaline operation, in diminishing irritability and permitting the secretion of a more healthy gastric juice. It is frequently administered in milk, which covers its taste; but the propriety of employing this vehicle is objectionable, because much of the lime is taken up in forming a saponaceous compound with the oily part, or cream of the milk, by which its influence on the stomach is greatly lessened. The medium

dose of lime-water is from two to four ounces—quantities equivalent to one grain and a quarter and two grains and a half of the lime.

The soft *Carbonate of Lime*, or chalk, when mixed with or suspended in water, is a more powerful Antacid; but it does not operate in allaying the irritability of the stomach so effectually as lime-water: it is, however, more serviceable when diarrhœa attends an acescent state of the stomach. It is supposed to form concretions in the intestinal canal; but my experience does not authorize this opinion.

2. MAGNESIA. *Magnesia*. L. E. D.—This hydrate has the advantage of lime water, from its forming a soluble and purgative salt with acid present in the stomach; but, whilst it does so, and thus carries off much of the already-existing acid, it does not allay the irritability of the stomach so effectually as lime-water, unless it be combined with an aromatic. Such an union greatly augments the influence of magnesia; and, in cases of violent vomitings, I have seen a teaspoonful or two of magnesia, administered in a glass of sherry wine, produce a more immediate sedative influence than any other means that I have ever seen employed. The *Carbonate of Magnesia* is also employed as an Antacid in the diseases of children; but, although in children the extrication of the carbonic acid which it contains, when much acid is present in the stomach, is an objection to its employment, yet in an adult this is rather useful, as the gaseous acid stimulates the nerves of the stomach and acts as a tonic. The dose of pure Magnesia should not exceed half a drachm; that of the carbonate is from a drachm to two drachms.

3. SOLUTION OF POTASSA. *Potassæ Liquor*. L. E. D.—This solution produces its effects as an Antacid both by neutralizing the existing acid and by its powerful influence in allaying the morbid irritability of the viscus. Keeping these facts in view, there is little doubt that, in order to obtain all the advantages which the medicine can afford, it ought to be given in much larger doses than are usually prescribed. It is true that the pure alkalies are powerfully excitant to the living system, and this in proportion to their concentration; thence they are employed as Escharotics when applied to the surface. But, although a large dose of the Liquor Potassæ,

taken into the stomach, even when much acid is present, if the habit be unaccustomed to the medicine, would undoubtedly prove injurious, yet the system rapidly accommodates itself to very large doses of this medicine; and its beneficial effects are rarely evident until the full dose can be administered. I have carried the dose of Liquor Potassæ to the extent of 120 minims, administered three times in twenty-four hours, with the most decided benefit, in obstinate cases of psoriasis, and some other cutaneous affections connected with an acescent state of the primæ viæ. It is necessary to state that the medicine cannot be carried to this dose when no acid is present in the stomach; for, as its first effect is to neutralize the existing acid, much of the Potassa is thus rendered merely purgative; and it is that portion only which is over and above what is required for this purpose that can be said to exert its specific influence on the coats of the stomach. Potassa, however, at least as an Antacid, may be safely brought to the dose that I have mentioned; and, as it then enters the circulation and stimulates the whole glandular system, it not only acts as a palliative by its chemical properties, but also tends to correct the disposition to acescency.

The best vehicle for administering this pure alkali is the almond emulsion, unless we wish to combine it with a bitter, in which case the infusion of gentian, or that of orange-peel or cascarilla, will answer every indication that we can desire it to fulfil. The dose may be at first from fifteen to twenty minims, which should be augmented, five minims at intervals of two or three days, until the full dose can be taken.

In weak stomachs, it is advisable to employ the carbonate of the alkali before using the pure alkali, as its action is not only milder, but, from the extrication of the carbonic acid, some advantage is obtained from its tonic influence, when applied to the sensitive nerves of the stomach, in the manner which must take place when this viscus is distended by it.

b. SALTS.

Some of these have been already noticed under the head of their alkaline bases: two only remain to be considered in this place.

1. CARBONATE OF SODA. *Sodæ Carbonas.* L. E. D.—This salt, as well as the bicarbonate, operates nearly in the same manner as the Carbonate of Potassa; but it appears to be more readily taken into the habit than that salt. After taking either of these carbonates for a short time, all the secretions, even the cutaneous perspiration, become very perceptibly alkaline. Its influence on the urinary secretion will be noticed under Antilithics. As an Antacid, its properties resemble those of the carbonate of potassa: it may be given in the same doses and the same vehicles.

2. CARBONATE OF POTASSA. *Potassæ Carbonas.* L. E. D.—The manner in which this salt operates, when taken into the stomach, has been already noticed under the head of the solution of the pure alkali. The Carbonate, owing to its deliquescent property, cannot be administered in substance. The dose of saturated solution is from m. xx to f℥i; it may be taken in any bland demulcent fluid.

3. SOLUTION OF AMMONIA. *Liquor Ammoniæ.* L. E. D.—Ammonia operates in the same manner as the other alkalies; but it communicates also a more powerful stimulus to the nerves of the stomach; and, from its volatility, readily acts on the acidity of the elastic vapour that frequently distends the stomach in dyspeptic affections. From fifteen to thirty minims of the Liquor Ammoniæ may be given in fifteen fluid drachms of any bland, mucilaginous fluid that can cover the acrimony of the medicine whilst it is passing the gullet. The decoction of Iceland liverwort, Cetraria *Islandica*, deprived of a portion of its bitter, has answered every purpose as a vehicle for the administration of Ammonia.

From what has been said, it must be evident that this class of medicines is of very limited application.

SECTION III.

ANTALKALIES.—MEDICAMENTA ANTALKALINA.

FREE alkalies are rarely present in the stomach; but that there exists what may be termed an alkaline state of habit is well known. It is demonstrated in the chemical quality of the urine, accompanied with a pale countenance, lassitude, irregular bowels, sometimes costive, sometimes too relaxed, and a tendency to hysteria in females. Mental as well as corporeal causes, diseases affecting the spinal cord, whether in the loins, back, or neck, or whether paralysis be present or absent, produce an alkaline state of habit which is displayed in the urine. The *acids*, undoubtedly, are indicated in such cases: the best is the nitric acid; and much benefit is derived from its employment.

SECTION IV.

ANTILITHICS*.—MEDICAMENTA ANTILITHICA.

Syn.—*Lithontriptics.*

THE appellation Lithontriptics, generally applied to this class of medicines, is calculated to mislead, as it implies substances which dissolve urinary calculi; and, therefore, as I regard the substances in this class rather as *preventives* of the formation of calculous concretions than as *Lithontriptics*, or destroyers of concretions already existing in the kidney or in the bladder, I have chosen the term *Antilithics* as the name of the class. Antilithics may be defined—" Substances which counteract the predisposition to the formation of calculous concretions in the urinary organs."

I am of opinion that it has been too much the custom to regard the formation of calculi in the pelvis of the kidneys and in the urinary bladder as mere chemical processes, and,

* From ἀντι, against, and λιθος, a stone.

consequently, to conduct the treatment too exclusively upon chemical principles, losing sight of the general effects of disease upon so important an excretory secretion as the urine. Both Dr. Marcet and Dr. Prout, two individuals to whose talents and industry the profession is more indebted than to any others for the lights which they have thrown upon this important subject, admit the truth of the remark which I have just made. "The only benefit," says Dr. Marcet, "which we may with any confidence expect from medicine in this disease is either to prevent the increase of calculi already formed, or, what is still more important, to guard the constitution of those who are subject to the disorder against the prevalence of the particular diathesis from which it arises*." In accordance with the same views, also, Dr. Prout quotes an observation of Berzelius, that, in a case in which the phosphoric acid was indicated and was largely given, no effect was produced until it proved laxative, when "the urine became acid and deposited uric acid, which continued as long as the laxative effect continued, and no longer, although the dose remained unaltered†." My own experience has also amply confirmed another remark of Dr. Marcet, that alkaline remedies "often allay the irritation of the bladder and promote the flow of urine, even when, from the chemical composition of the concretions, they can be of no service as solvents." A remarkable instance of the beneficial effects of general remedies—those which have no influence whatever on the calculus which excites the irritation—occurred to me some years since, and is a powerful illustration of the point under consideration. An elderly man, the master of the workhouse of the parish of Chelsea, placed himself under my care on account of a violent pain which he had experienced, for several years, across the loins, and which was accompanied with urine of a coffee colour and scanty in quantity. There was little difficulty in discovering the cause of these symptoms, and that the pain proceeded from irritation in the pelvis of the kidney from the presence of a calculus. To combat the symptoms, and under the sup-

* Marcet's Essays on Calculous Disorders, 8vo. 1817, p. 143.

† Prout's Inquiry into the Nature and Treatment of Gravel, Calculus, &c.

position that at least the irregular surface of the calculus, which I suspected to be the chief source of irritation, might be smoothed by such chemical agents as were likely to pass to the kidneys unaltered, both acids and alkalies were alternately administered without any advantage, although carried to full doses; and, after some months, symptoms of dropsy supervened. With the view of relieving the dropsical disease, diuretics—foxglove and mercurials—were administered until the mouth became affected. As salivation supervened, the pain abated, the urine remained clear, and every symptom of calculus disappeared and continued absent as long as it was requisite to keep up the mercurial action on the habit; which was persisted in until the dropsical fluid was totally evacuated. On leaving off mercury, as soon as the mouth became well, the pain of the loins recurred, and, in a short time, the urine again became loaded with broken-down blood or the coffee-coloured sediment. For three years, circumstances required that the mercurials should be occasionally employed; and, in every instance, the beneficial effects were such as I have described. At length I had occasion to go to Scotland for two months; and, during my absence, my patient again lost ground. On my return, I found him in the last stage of dropsy, under which he sunk in a few days after I saw him. The post-mortem investigation of the body confirmed my opinion of the state of the kidneys: the pelvis of the right kidney was filled with an irregular calculus, which had assumed the form of the pelvis and its branching infundibula, and completely filled them, so as almost to prevent the passage of any urine into the ureter on that side. I mention this case as à fair illustration of the effects of remedies, not operating in any way upon chemical principles, in allaying pain and clearing the urine, in a case all the symptoms of which so decidedly arose from the irritation of a calculus. Indeed, when we reflect upon the changes which disease effects on the urinary secretion, we shall be more and more convinced that the object of the *chemical* practitioner is, as Dr. Prout has expressed himself, "at best but of a secondary description; namely, to prevent the effects of disease rather than to remove it." In order to understand the manner in

which Antilithics operate, it is necessary to enquire into some peculiarities connected with the secretion of the urine. Some of the saline matters contained in human urine are more liable than others to form deposites, owing to their comparatively little solubility; namely, the phosphates of lime and of magnesia and the lithic acid. The two former are held in solution by the phosphoric and lactic acids, which are always in excess in healthy urine; for, when these are saturated by a few drops of ammonia, both the phosphates are precipitated: on the contrary, when any acid, in small quantity, is added to recent healthy urine, lithic acid, in small reddish crystals, is thrown down. Diseases operate nearly in the same manner in producing urinary deposites. Thus, in inflammatory diseases, we find the urine high-coloured, peculiarly acrid, and throwing down no deposite until the disease begin to yield, when it lets fall a copious, pink-coloured sediment, consisting of the *rosacic* and *uric* acid, with a little phosphate of lime. The urine of those persons who labour under a gouty diathesis—that is, who are predisposed to gout—contains much less phosphoric acid than that of healthy individuals; and, even although the quantity of this acid is increased during the actual presence of the gouty paroxysm, yet much less, at this time, than is usual in healthy urine. This is also the case in rheumatism; and, as in other inflammatory diseases, in the decline of the paroxysms of both these affections, there is a copious deposition of *rosacic* acid. In healthy urine, the phosphates are in small quantity; but, in derangements of the chylopoetic viscera and in low states of the habit, it is from the abundance of these compounds that calculi, both in the bladder and in the kidneys, are formed.

In dropsy, the urine is loaded with albumen and becomes milky, coagulating when acids are added to it; but, if the dropsy be connected with diseased liver, the urine is scanty, high-coloured, depositing largely rosacic acid, and is entirely free from albumen. It is probable that the nitrogen, which exists in albumen to the amount of fifteen per cent. is exhausted in the formation of the lithic acid in these diseases; this acid requiring nitrogen as one of its components: and thence the necessity of a vegetable diet in such cases.

Urea, which, in its pure state, is transparent, colourless, and in four-sided prisms, soluble in their own weight of water at 60°, is a principle peculiar to urine, depending probably, as Dr. Prout has suggested, upon the action of the kidneys on the albuminous matter of the blood: its ultimate constituents are—4 equivalents of hydrogen, + 12 parts or 2 equivalents of carbon, + 16 or 2 of oxygen, + 28 or 2 of nitrogen; making the equivalent of the urea 60.

Lithic acid is a compound of the same constituents, but in different proportions; namely, 2 parts or equivalents of hydrogen, + 36 parts or 2 equivalents of carbon, + 24 or 3 of oxygen, + 28 or 2 of nitrogen; making the equivalent 90: but, as this contains 2 parts of water, the equivalent of the anhydrous acid is 72. Dr. Prout is of opinion that it is always in combination with ammonia, as a lithate, in urine. In *hysteria*, the urine is in large quantity, limpid, colourless, and containing scarcely any urea; and, in *chronic hepatitis*, it is totally devoid of it. In *rickets*, the urine is loaded with phosphate of lime; in *diabetes*, with saccharine matter; and, in *dyspepsia*, it contains so much gelatin that it yields a copious precipitate with tannin.

The conclusion to which these observations lead is this—that, when the urine displays such variations of chemical character from the effects of disease, and when these chemical changes are removed, not by any agents directed to effect chemical action on the secretion itself, but by general remedies directed to fulfil the indications which these states of disease present—there is every reason for not confining our attention, in the treatment of calculous diseases, too exclusively either to the chemical constitution of the urine, or that of the calculous concretions deposited from it. In making these remarks, it is not my intention to take too limited a view of what may be termed the calculous diathesis and its treatment: nor is there any occasion to detract from the great advantages which have been derived from chemistry in this branch of therapeutics. Without a clear understanding of the chemical nature of urinary calculi, we should be but ill fitted for affording relief, even in taking a simple pathological view of the cases that, daily, are brought under our notice.

In treating of diuretics, I noticed the components of urine, as obtained by the analysis of Berzelius; it is therefore now only necessary to mention that its chief components are, besides water, *urea*, *lithic acid*, *free lactic acids* and *lactates*, *sulphates of potassa* and *soda*, *phosphates of soda* and *ammonia*, *muriates of soda* and *ammonia*, and some earthy *phosphates*. In stomachic diseases, the more or less assimilating quality of the food, and even the nature of the food, favours the production of these compound salts, and calculi are the result. The following is the nature of the four kinds of calculi, under which all the others may be arranged:

1. The *Lithic Calculus* is of a flattish-oval figure, brownish or fawn-coloured, surface smooth, has the texture laminated: soluble in the pure alkalies, but not in their carbonates, sparingly in water; insoluble in sulphuric and muriatic acids; but soluble in the nitric, and, on evaporating the solution to dryness, a bright pink residue is left, which disappears on adding either an acid or an alkali. The Lithic Calculus evaporates before the blow-pipe, leaving a white alkaline ash.

2. *Mulberry*. Colour dark-brown, surface tuberculated, substance hard. It consists chiefly of oxalate of lime. In fine powder, it is soluble in muriatic and nitric acids; but not in the pure alkalies. When Mulberry Calculi are exposed to heat, the acid is volatilized, and quick lime remains. Some have no tuberculated surface, but are smooth, as illustrated in what is called the hemp-seed calculus.

3. *Phosphate of Lime*. Colour pale-brown; surface smooth, as if polished; texture laminated, so as to separate into crusts. In fine powder, it dissolves in nitric and muriatic acid. It is fused in an intense heat.

4. *Ammoniaco-Magnesian Phosphate*. Bright-white, little compact, surface studded with crystals. Before the blowpipe it gives out an ammoniacal odour, and then fuses. The crystals are sparingly soluble in water, but readily in the acids. Pure potassa disengages ammonia from them.

5. *Fusible Calculus*. The whitish and most friable of all, soiling the fingers like chalk: when the texture is laminated, the layers are often studded with crystals of the triple phosphates. Fusible calculi often acquire a great size: they con-

sist of a mixture of the triple phosphate and phosphate of lime.

There are, besides these, others, which are termed *cystic*, *alternating*, and *compound calculi;* but they are very rare.

In treating of this class of medicines we must regard those articles which are embraced under it in two points of view—1st. As fitted for removing the symptoms that indicate the first formation of calculous deposites in the habit; and these I would regard as *Antilithics*, or preventives of stone; 2dly. As fitted to act upon calculi already existing in the kidney or in the urinary bladder; and, by wearing down or smoothing their asperities, to diminish their irritating powers, if they cannot altogether dissolve them; and these I would denominate *Lithontriptics*, or solvents of calculi.

There can be no doubt that the first part of our enquiry is the most important, and that most likely to prove practically useful. It has been said that it is in this state of the complaint that solvent medicines or Lithontriptics are likely to prove serviceable; I would say, that it is in this stage of the disease that the accumulation of calculous matter is likely to be prevented; and that the plan of treatment should be begun so early after the first symptoms display themselves, that the gravel or calculous matter deposited shall be readily washed out by the urine. The question then presents itself—what are these symptoms? and it is followed by another—what are the *Antilithics*, and in what manner do they operate to effect the changes which are desired?

There are three substances which principally form the gravel and calculous matter deposited in the urine; *uric acid*, *phosphate of lime*, and *phosphate of ammonia* and *magnesia:* and it is of great importance to be aware of the first indications of these in the urine, in quantity sufficient to afford deposites.

Whatever generates free acid in the stomach favours the deposition of *lithic* or *uric acid*, the existence of which is well known by the name of red gravel; it is the disease, therefore, of dyspeptics, especially when this is attended with a dry state of skin; this acid being, in a healthy condition of the habit, freely thrown off by the cutaneous exhalants. Two

thirds of the calculi generated in the kidney consist of this acid. The opposite state of the system favours the deposition of the phosphates: the stomach is generally deranged; and when the bladder has lost any of its muscular energy, as in cases of disease of the prostate, in affections of the spine, and in very old people, the urine is so long retained in the bladder as to undergo a partial decomposition, ammonia is generated, and a deposition of the ammoniaco-magnesian phosphates take place. It thus appears that these two deposites at least are wholly influenced by the state of the general health. Let us now take a view of the means of counteracting these states.

But whatever may be the cause of urinary deposites, the knowledge of their nature teaches us the necessity of varying our means according as they are of an acid, an alkaline, or a mixed character.

TABLE OF ANTILITHICS.

A.——— when an Acid is indicated.

a.—MINERAL ACIDS,

Sulphuric Acid,
Muriatic Acid.

b.—VEGETABLE ACIDS,

Tartaric Acid,
Citric Acid,
Carbonic Acid.

B.——— when an Alkali is indicated.

c.—OXIDES,

Solution of Potassa,
Magnesia,
Lime Water.

d.—SALTS,

Carbonate of Potassa,
Carbonate of Soda.

C. ——— when Tonics are indicated.

e.—VEGETABLE BITTERS.

f.—VEGETABLE ASTRINGENTS.

D. ——— when local Lithontriptics are indicated.

g.—ACIDS.

h.—ALKALIES.

SUBSTANCES WHICH OPERATE AS ANTILITHICS.

a. ACIDS.

Before entering upon the consideration of the efficacy of particular acids as Antilithics, this question presents itself for consideration—Are acids carried to the urinary organs through the circulation? The free acid generally present in the urine renders it difficult to satisfy the mind upon this point. It has been ascertained that sulphuric acid enters the circulation; for, in the case of a pregnant female who was poisoned with it and gave birth to a child in the expiring throes of life, sulphuric acid was detected both in the body of the infant and in the liquor amnii. The experiments of Mr. Brande* also render it at least probable that carbonic acid reaches the bladder.

Whenever the quantity of the natural acids of urine is diminished below a certain point, we find that white sand is deposited. The cause of this deposite is generally some disordered state of the digestive organs; and the occasional appearance of it is of little consequence, if it occur only after irregularities in diet; but, if it appear daily, and after our ordinary meals, and particularly if it be voidable in a visible state in the urine, and do not simply appear as a deposite, on the cooling of the fluid, then it ought to obtain our serious attention. It more easily collects and forms into calculus than other deposites; and this is peculiarly favoured, if, from

* Philosophical Transactions, 1808, p. 242.

stricture of the urethra, or any other cause, the bladder be not completely evacuated when the urine is passed. Remedies, in this case, ought to be immediately resorted to; and, as it is well known that this *white* sand consists of the phosphates, acids are indicated: let us, therefore, next determine the value of these as remedial agents.

1. MINERAL ACIDS.—All of these have been employed in cases depositing white sand: the *nitric* has been supposed to disagree with some stomachs, exciting flatulency and eructations, and therefore is seldom used; but this objection is not valid: I have given it in large doses; and Mr. Brodie has carried it to the extent of f℥i in the day without inconvenience; at all events, this objection cannot be brought against the *sulphuric* and *muriatic*, either of which may be employed for adults. The muriatic acid acts more upon the bowels; and, as an open state of these always tends to relieve the condition of habit which encourages the deposition of the phosphates, it is to be preferred to either of the others. When it agrees with the stomach, the *muriatic acid* diminishes this deposite; or, more correctly speaking, prevents its further formation. Many persons who suffer from acidity of stomach can take muriatic acid with impunity. The dose of the acid is from ten minims to twenty, or even fifty, in any mucilaginous fluid; but, after its influence is experienced, the dose should be diminished; and, if any uric acid appear, the use of the mineral acid should be altogether intermitted. These remarks apply particularly to adults; for, in the cases of children, the vegetable acids are always to be preferred.

2. VEGETABLE ACIDS.—It is probable that the Vegetable Acids undergo decomposition during the process of assimilation, or, as it is termed, in transitu; and, as in this state new compounds are formed, it is difficult to predicate whether these are likely to prove salutary or prejudicial. The *tartaric acid* has not been much employed; but, if we regard it simply as an Antilithic, operating on the stomach, it is as likely as any other to prove beneficial.

An excellent method of administering the tartaric acid to children, is in the form of imperial, made with the bitartrate of potassa, which, besides communicating this acid, has

also the advantage of keeping the bowels in a soluble state. But it must be recollected that the bitartrate of potassa is one of those salts which, when taken for some time, is supposed by Dr. Paris to be decomposed in the stomach, and to afford its alkaline principle only to the kidneys. When treating of this salt as a diuretic, I pointed out the probable fallacy of this opinion; as, the moment its superabundant acid is consumed by the digestive process, the tartrate thus formed will act on the bowels, and carry itself out of the habit; and I have no doubt that the purgative effect of the bitartrate is probably, on every occasion, owing to this change.

Mr. Brande, in his observations "On the Medico-Chemical Treatment of Calculous Diseases," states his preference for the *Citric Acid*, which may be given in doses of from gr. v to ʒss; and it has the advantage of being highly relished by children.

It is extremely probable that much of the benefit arising from these acids proceeds from their action on the digestive organs, correcting irregularities of these organs, and particularly of the liver, in those persons who pass the *ammoniaco-magnesian phosphates;* but it is also probable that they partly find their way to the kidneys and bladder, as they have proved useful in relieving those cases of elderly persons, who, from some affection of the urethra, or from the disability of completely evacuating the bladder, have a tendency to the accumulation of the phosphates in that viscus. This idea of the penetration of acids to the bladder was particularly believed in reference to carbonic acid, before the nature of urinary calculi was understood: thence any reasoning upon its action must necessarily have been very imperfect; and, from the experiments of Dr. Marcet*, the passage of carbonic acid from the stomach into the urine is very improbable. On the other hand, we know the tonic influence of carbonic acid when applied to the nerves of the stomach, independently of any chemical agency, and therefore its influence as an Antilithic may depend on this property.

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* Marcet on Calculous Disorders, 8vo. p. 160.

b. ALKALIES.

The *Alkalies*, it is almost unnecessary to remark, are to be employed in the opposite condition of the system from that indicating the use of acids; that is, when there are deposites demonstrating the presence of *lithic* or *uric* acid. In the management of these Antilithics, many obstacles were at one time thrown in the way, from a fallacious opinion that the caustic or pure Alkalies are likely to injure the stomach, and could not be taken to an extent sufficient to reach the kidney, without being neutralized by the acids in the urinary secretion. Now, although this might be an argument of some weight, were it correct, against the employment of the pure Alkalies as Lithontriptics, yet it is certainly none against their use as Antilithics; for, in those instances in which the lithic acid diathesis prevails, this is more connected with the state of the digestive organs than in those cases in which the phosphates are deposited. The first effect of the pure alkalies upon the stomach is to allay irritation, and thence to lessen that hasty secretion of the gastric juice which favours acidity. Indeed, in almost all cases, I am disposed to ascribe the advantages derived from alkalies, in correcting acidity of the stomach, less to their neutralizing the acid already existing in the organ, than to their sedative power, and the taking off that state of irritability which, by affecting the secretion of a hasty and imperfect gastric juice, favours the production of acid. With regard to the injury arising from large doses of the pure alkalies, these may have arisen from the indiscretion of too rapidly bringing up the dose; but, when this is done with caution, the *pure potassa*, in the solution ordered by the London College, may be given to the extent of even m. cxx, three times a day, with evident advantage to the habit in every respect.

The question again presents itself—are Alkalies conveyed into the bladder? There is no difficulty in determining our reply in the affirmative: they certainly reach the urinary organs, and operate in not only checking the prevailing diathesis, but in bringing on a calculous deposit, depending on an opposite condition of the habit, when they are given in

excess and have been too long continued. This must be carefully avoided; and, as soon as the urine tinges paper of litmus which has been reddened, to blue, or turmeric paper to brown, the use of the alkalies must be discontinued. Sometimes, however, they may be long used with the greatest advantage. A very satisfactory case, illustrative of this fact, has been recorded by Dr. Marcet. The patient was a clergyman; he persevered in the use of an alkaline lixivium for ten years, and during that time passed many calculi, all of which had their angles rounded, "and their edges blunted in a manner which could hardly be explained except from the long-continued effect of the alkaline medicine*."

The *carbonates* are mild forms of exhibiting the Alkalies; and, if the results which are recorded of their beneficial effects be correct, in many instances they are preferable forms for the administration of alkaline remedies. The carbonates of soda, either in soda water, or in the form of the bicarbonate, are those usually preferred; but, from whatever cause it may arise, experience has decided that *potassa* has a much more powerful antilithic effect than *soda*, whether uncombined or as a carbonate. One excellent reason for preferring potassa or its carbonate, is the fact ascertained by Dr. Prout, that the lithate of potassa is a soluble salt, whereas the salt formed with the lithic acid and soda is insoluble. The dose of the bicarbonate of soda is from gr. x to ʒss, and it may be taken two or three times a day. In this case the carbonate is decomposed in the habit, and the Alkali only is carried to the kidney. With regard to *ammonia* and its carbonate, it is probable that the whole of its effects are due to its influence on the stomach; and indeed it is upon this principle that it appears to act so favourably in those cases of the gouty diathesis in which the deposition of red gravel, as it is termed, from the urine, alternates with fits of gout, or in which the disease appears to affect the joints and the kidneys alternately.

In this condition of the habit the use of *magnesia* as an antilithic remedy was brought before the notice of the profession in a paper, by Mr. Brande, published in the Philo-

* Loco citato, p. 151.

sophical Transactions for 1810, and noticed by him again in an essay which is printed in the 6th vol. of the Journal of Science and the Arts. The observations of Mr. Brande have in a great degree been confirmed by subsequent experience; and magnesia is now much employed as an Antilithic. It is very evident that this substance can only exert its influence in the stomach; and, when it is combined with bitter vegetable tonics, and precautions are taken to prevent its accumulation in the bowels, by the occasional use of purgatives, individuals liable to the constant formation of red sand have been effectually relieved. But, if the magnesia or even Alkalies be depended upon, without proper attention to improve the tone and general state of the digestive organs, disappointment will follow the employment of the best Antilithics. The dose of the magnesia is from gr. x to gr. xxx of the calcined, and from ℈i to ʒi of the subcarbonate. When there is reason for thinking that the alternating calculi are forming, then, it is said, that the acids and the alkalies should be alternately administered. But this recommendation involves too chemical a view of the subject; the alternate depositions of lithic acid and the phosphates do not so much indicate a state of stomach at one time acescent and at another alkalescent, as it indicates a continued state of indigestion, varying, from accidental circumstances, its influence on the urinary organs, and only requiring to be removed to prevent the future deposition of either kind of calculous matter*. The only mode of relieving stone already existing in the bladder is by the aid of surgery: for, with regard to the power of relieving from stone already existing in the bladder, chemistry must yield the palm to surgery, at least as far as our present knowledge extends. This is not the place to notice improvements in surgery; but, if I may be permitted

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* Besides the Essays of Mr. Brande, already noticed, much information on this subject will be found in the work of Dr. Marcet on "the Chemical History and Medical Treatment of Calculous Disorders;" in the masterly volume of Dr. Prout, entitled "An Inquiry into the Nature and Treatment of Gravel, Calculus, and other Diseases connected with a deranged Operation of the Urinary Organs;" Dr. Woollaston's papers in the Phil. Trans.; and a paper by Dr. W. Phillips, in the 6th vol. of the Medical Transactions.

to offer an opinion as a member of the profession, I should say that no operation in my time has advanced so greatly this branch of surgery as that now practised by Baron Harteloup, M. Civiale and his pupil Mr. Costello; namely, the attrition of the calculus in the bladder.

c. TONICS OPERATING AS ANTILITHICS.

If the opinions which have been delivered respecting the connection between the state of the stomach and the urinary secretion be correct, it will be readily perceived that the importance of obviating any irregular action of the digestive organs should be the first attempt to cure the disposition to the formation of calculus. This part of our subject involves a long and interesting inquiry into the nature of dyspeptic affections, which would be out of place in this work. I will, therefore, confine my remarks to the influence of *Tonics* and *Astringents*, as Antilithics.

The *Tonics* generally employed in cases of a disposition to calculi are the vegetable bitters; and, when the indigestion depends on the simple deficiency of tone in the stomach, preventing the secretion of a due quantity of gastric juice, these are undoubtedly serviceable; but in few cases indeed, as far as my experience has enabled me to form a judgment, does the dyspepsia that produces calculi depend on this cause. If we reflect on the fact, that it is in the gouty diathesis and in similar states of the habit that calculi most frequently occur, in states of the stomach arising from over-excitement, and excessive indulgence and indolence, we have no difficulty in satisfying our minds that the irregular secretions of the stomach in such cases depend, as I have already stated, rather on a subacute inflammation of the viscus than on simple debility. This is the state in particular in which there exists a superabundant acid, and in which deposites of lithic acid are noted. In these instances, therefore, any expectations of benefit from bitters will undoubtedly be disappointed. It is in the opposite state of the stomach, such as occurs from the course of years, when the debility is direct, and the deposites are of an ammoniacal nature, that bitters are really serviceable; and the choice of the substances is of little moment, pro-

vided they are of a kind to pass partly into the circulation, and to give a moderate degree of stimulus to the kidneys. For this reason, those bitter vegetables which at the same time contain an astringent principle are more serviceable than the simple bitters. This indirect influence of astringents on the urinary organs has been well known from a very early period, although their efficacy was erroneously ascribed to their exercising an expulsory power—an opinion that prevailed until it was corrected by Dr. Cullen, who first pointed out the influence of tonics and astringents in relieving the symptoms of calculus, independent of any chemical or solvent properties which they were formerly conceived to possess.

The only tonics which demand particular attention as suited for antilithic purposes are the Diosma *crenata*, a plant the leaves of which have found a place in the last edition of the Dublin Pharmacopœia, and Pareira Brava.

1. Diosmæ crenatæ Folia. *Buchu Leaves*. D.—This plant is a native of the Cape of Good Hope: it belongs to the natural order Diosmeæ*. The name Buchu is derived from the word *bocchae*, which is given to the plant by the Hottentots. To an inexperienced eye, the leaves of this species of Diosma very much resemble those of Senna; but, when the two are carefully examined, the difference is very obvious: they vary in length from half an inch to one inch, in breadth from half an inch to five-eighths of an inch; the base is equal and attenuated, with a short, channelled footstalk; the apex is obtuse; and the margin beautifully crenated; whence the name of the species. The upper disc is smooth and shining, and of a yellowish olive hue, caused by innumerable glands; the under is rugose, with few but comparatively larger glands than on the upper disc. The leaves are generally mingled with the stalks, which appear notched, owing to the minute petioles of leaves which have fallen. The stalks are of a reddish brown hue, mottled with bright yellow. The leaves of Buchu, when recent, exhale a powerful, not unpleasant, aromatic odour, and taste bitterish, somewhat like peppermint, leaving a pungent impression, with some degree of sweetness, on the tongue. These properties are imparted to

* Woodville's Med. Bot. third ed. vol. v, p. 51.

water and also to proof spirit, and seem to depend on volatile oil and extractive.

According to the analysis of Cadet de Gassicourt, these leaves contain volatile oil, gum, extractive, resin, and chlorophyle. The infusion is precipitated by infusion of galls and acetate of lead: the persulphate of iron produces a green colour in it.

The medicinal properties of Buchu leaves are such as render them admirably adapted for calculous complaints, as, at the same time that they afford tone to the digestive organs, they are sudorific or diuretic according to the state in which the surface is maintained. Thus, if the deposite be lithic acid, owing to the state of the surface, the Buchu leaves, by their sudorific influence, counteract this state, whilst, at the same moment, they are giving tone to the constitution, and, thereby, promoting in both ways that condition of the habit which is least favourable for the formation of red gravel*. The Dublin College have ordered both an infusion and a tincture of these leaves, either of which may be advantageously administered in all cases of the calculous diathesis in which tonics are indicated. The preparations of Diosma *crenata* have long been a favourite remedy with the Dutch in diseases of the urethra, prostate gland, and bladder of urine.

2. PAREIRA BRAVA. *Cissampelos Pareira:—Radix*†.—This species of Cissampelos, the Abuta *amara* of Aublet, is a native of South America and the West Indies, belonging to the natural order Menispermeæ. The root, which is the part employed, is long, thick, woody, and covered with a furrowed, brown bark.

According to the analysis of M. Feneulle, it contains a soft resin, yellow colouring matter, a brown principle, fecula, an azotized matter, acidulous malate of lime, nitrate of potassa, and some mineral salts. This analysis throws little light upon the medicinal principle of the roots of Pareira

* A spirit, distilled from the leaves of the Diosma in the leys of wine, is regarded by the natives of the Cape of Good Hope as a sovereign remedy in chronic affections of the bladder.

† Woodville's Med. Bot. third ed. p. 168, pl. 65.

Brava, which was known to the Brazilians as an excellent remedy in all obstructions of the urinary organs long before its introduction into Europe. The root is nearly inodorous: its taste is sweetish, with some degree of bitterness and slight acerbity. It yields these properties to both water and alcohol; but its best menstruum is proof spirit. Helvetius was among the first of the European physicians who investigated its influence in nephritic and calculous cases: he ascribed its efficacy to lithontriptic powers; and Geoffroy to its solution of the mucus to which the sabulous matter adheres in calculous diseases: but it is more probable that its effects are due to its tonic influence on the bladder. Mr. Brodie extols its powers in chronic inflammation of the bladder: it diminishes the irritability of the organ, and diminishes the secretion of the ropy, alkaline mucus. The decoction is prepared by simmering four ounces of the root in three pounds of water, until the fluid is reduced to two pounds, and then straining. From six to twelve fluid-ounces of this decoction may be taken in twenty-four hours. Mr. Brodie adds to it the tincture of Henbane; and, where there is any deposite of the triple phosphates, indicated by milky urine, with an irridescent pellicle on the surface, he adds muriatic or nitric acid.

D. LOCAL LITHONTRIPTICS.

These consist of alkalies and acids, properly diluted, injected into the bladder; but it has been ascertained that the bladder cannot bear the degree of strength of an alkaline injection sufficient to dissolve a lithic calculus. Some experiments of Mr. Brodie, however, have demonstrated that loose concretions of the phosphates and of carbonate of lime can be acted upon by a weak solution of nitric acid, and thus gradually removed from the bladder. The strength of the solution used by Mr. Brodie was two minims and a half to each fluid ounce of distilled water. No suffering attended the injection, which was effected through a double cannula of pure gold; but the patients experienced relief from all their symptoms, the adhesive mucus from the coats of the bladder was lessened, and the frequent desire to empty the bladder much abated. By testing the fluid which had been employed

and passed through the bladder with a concentrated solution of ammonia, the phosphates were abundantly precipitated; thus proving that the calculi in the bladder had been acted upon.

In concluding this brief sketch of this class of medicines, I have only to remark that it is only on *Antilithics*, as preventives of calculi, that we can place any reliance; and these we find in acids and alkalies, as circumstances may demand; but not less in whatever promotes the healthy functions of the digestive organs and those of the skin—that temperance, exercise within due limits, a regular and somewhat open state of the bowels, and restoring the tone of the system when it fails, constitute the best aids to the influence of Antilithics.

SECTION V.

DISINFECTANTS.—MEDICAMENTA ANTIPESTIFERA.

Syn.—*Antiseptics.*

BEFORE examining the substances which act as disinfectants, it may be proper to acquire some correct ideas of the nature of infection and contagion. Both produce diseases in those who are in contact with or near the sick, without the influence of the imagination.

It is unnecessary to enquire into the causes that influence the production of the same symptoms when a contagious disease is communicated, whatever may be the state of the system of the person receiving the contagion. The matter, whether it be introduced into the blood, as in inoculation of syphilis, small-pox, or cow-pox, or be conveyed through the medium of the air, as in the case of infection, is the true fomes of the disease, and can communicate a disease only of the exact nature of that which generated it. But this virus, whatever may be its nature, can be received in certain states of the living system only; and it is probable that the causes

which are suspected of originating a contagious fever, or disease of any kind, are often those which bring the body into that state which is best fitted to receive the impression of the exciting causes of the disease, however these may be produced. Thus, in a crowded, ill-ventilated apartment, such as the black hole of Calcutta, or the crowded births of transport vessels, or ill-ventilated jails, the effluvia arising from the bodies of many individuals becoming, as it were, stagnant, are capable of so lowering the vitality of the habit as either to produce disease itself or render the body more susceptible of diseased impressions. Whichever of these opinions be correct is of little importance for our purpose: it is sufficient to know that diseases often arise from certain impregnations of the atmosphere. These are of several distinct kinds. 1. the proportion of carbonic acid in a limited portion of air may greatly exceed that which can be borne by the living system with impunity: 2. hydrogen and its compound gases may superabound, constituting malaria or miasmata: 3. there may be a large proportion of gaseous matters, the products of putrefying animal substances, and of an *alkaline nature:* 4. the air may be tainted with matter emanating from the bodies of persons labouring under contagious diseases. All of these substances, when largely diluted with atmospherical air, exert little influence on the body; but, in a more concentrated state, they produce the most deleterious effects. These substances are supposed to operate either by an immediate impression on the nerves or by being taken into the system through the lungs or the stomach, into the latter of which they are supposed to be carried by the saliva. It is difficult to decide which of these opinions is correct: in my opinion, a nervous impression is all that is required; and this may be made upon the surface generally or upon the mucous membrane: in either case, there exists a sufficiently widely extended sensitive membrane on which the infectious atoms may operate.

It has always been supposed that the matter of infection can be destroyed by decomposition; and, for this purpose, means the most opposite have been, at different times, adopted, such as large fires, concussions given to the air by

firing gunpowder, and the sprinkling of water. For a long time also it was supposed that all substances which aid in retarding the progress of the putrefactive process, in dead animal matter, would also destroy the matter of contagion or infection; and thence camphor, resins, bitumens, benzoin, and aromatics, were employed, as well as vinegar, in the apartments of the sick and in hospitals; and, indeed, it was not until the close of the eighteenth century that the inadequacy of these means was acknowledged. It is unnecessary to notice the numerous schemes for disinfecting which have been proposed: three only deserve attention—the employment of *muriatic* and *nitric acids* and of *chlorine gas*.

a. ACIDS.

1. *Muriatic Acid.*—Morveau conceived that the nature of contagion could be determined by chemical tests; but, in forming this opinion, he was mistaken. He ascertained, however, that some gaseous agents can destroy certain noxious effluvia; and he imagined that the power of gases to effect this was in the ratio of their facility in parting with their oxygen: but, after many experiments with a variety of substances, he at length discovered that Muriatic Acid, in the gaseous state, was the best adapted of those substances which he had tried for effecting this purpose.

In 1773, Morveau was employed to disinfect the Cathedral of Dijon, which had been rendered unfit for religious service by the emanations from the vaults beneath it. He effected its purification by diffusing through it the vapour extricated from six pounds of common salt, on which were poured two pounds of concentrated sulphuric acid. In this case Muriatic Acid was evolved, which so completely neutralized or destroyed the noxious effluvia, that worship was performed in the church four days afterwards. In the same manner he disinfected the prison of the same city, into which the infection of a most malignant fever had been carried from other jails. The success of Morveau brought Muriatic Acid into general use; and its powers must still be acknowledged, although more powerful means have been, since that time, employed.

Some inconvenience arises from using the proportions of

salt and acid employed by Morveau; instead of which, the proportions now adopted are twelve parts of acid to fifteen of muriate of soda, which should be moistened before the acid is poured on it. No heat is required: the ingredients may be mixed in flat earthen dishes, and left to exhale the gaseous acid formed by the decomposition of the muriate.

2. *Nitric Acid.*—In 1780, Dr. Carmichael Symthe suggested the employment of nitric acid fumigations; and received a Parliamentary grant of £10,000 for his invention. His experiments were made in the depôt of Spanish prisoners at Winchester, during the progress of a fever, of a most destructive character, which carried off a large proportion of those unfortunate men.

The *Nitric Acid Fumes* were extricated by mixing together equal parts of nitre and of strong sulphuric acid. It is not easy to account for the efficacy of this acid, unless we suppose that it combines with the ammonia, in the same manner as the muriatic acid fumes, and forms nitrate of ammonia, which precipitates the acrid fœtid oil, supposed to constitute the contagious agent. But I am disposed to think that the influence of this gas is exerted rather on the body of the patient who is exhaling the contagious effluvia, than on the atmosphere. The effect of Nitric Acid, when largely diluted and taken into the stomach, is that of a powerful tonic; and this is well demonstrated in very low states of the habit, such as occur in purpura, in which the blood is poured out from the capillary vessels, producing spots on the skin, and there is a general solution of continuity, approaching almost to a state of putrefaction: nothing, in such a condition of the system, so rapidly brings up the tone of the habit, and, as it were, rouses the vital energies, as Nitric Acid. Now, in crowded ships and hospitals, where infectious fevers exist, the atmosphere, it is true, is loaded with the fomes of contagion and noxious effluvia; but, if the powers of life can be sustained, the body can withstand its baneful influence; and, at the same time, a smaller quantity of fresh effluvia must necessarily be thrown off by the patients, if they are in a state of less debility, than before. In this manner, I am of opinion, Nitric Acid fumes operate in hospitals and prison ships; whilst they act in purifying the

atmosphere only to a certain extent, by destroying the ammonia which is the vehicle of the fœtid effluvia, whatever these may be. Be this as it may, Nitric Acid is less useful than muriatic acid, and especially in purifying infected houses and clothes; but it has one advantage over muriatic acid—it is less inconvenient to the individuals who are in the apartments during their fumigation; and therefore may be used in situations where the sick cannot be removed.*

In using the ingredients for extricating the Nitric Acid, it should be recollected that half an ounce of each is sufficient for disinfecting an apartment containing a thousand cubic feet of air. In large apartments it is better to multiply the vessels containing the ingredients than to use them in a large quantity in one vessel.

b. CHLORINE.

Chlorine gas, for the purposes of disinfecting, is extricated from a mixture consisting of equal parts of dry sea-salt, chloride of sodium, and of peroxide of manganese, acted upon by two parts of sulphuric acid mixed with one part of water. The salt should be intimately mingled with the peroxide of manganese in powder, and the diluted acid be allowed to cool before it is used. The ingredients may be put in common earthen-ware pans.

Chlorine was first suggested as a disinfecting agent by Fourcroy, in 1791: it was afterwards adopted by Morveau, in preference to muriatic acid; and has been since very generally employed. As I have stated, Morveau imagined that miasmata depended, in a great degree, on the extrication of ammonia, combined with, or holding in solution, an acrid, fœtid oil. Whether this opinion be critically correct, it is true that ammonia is largely formed in putrefying animal matter, probably by the union of nitrogen and hydrogen, both of which are abundantly given out during the process of putrefaction. Now, the same effluvia are obviously emanated

* The Nitric Acid was first used by Dr. Johnston of Kidderminster; but the most decisive proofs of its efficacy were displayed on a large scale in the depôt of Spanish prisoners at Winchester, and in the Russian fleet, by Dr. Carmichael Smythe.

in very crowded apartments, and wherever circumstances occur to lower the powers of vitality. As far as the ammonia is concerned, we can readily conceive how the muriatic acid gas operates, as, the union of the ammonia and the acid gas forming muriate of ammonia, this substance is incapable of holding the fœtid, acrid oil in solution: it is precipitated and rendered inert. But muriatic acid vapour has little effect on some of the other deleterious gases—such, for example, as carburetted and sulphuretted hydrogen; it is, therefore, now seldom used, Chlorine being extricated with equal facility; and, besides answering the same purpose as the muriatic acid gas, decomposing readily both the above-mentioned gases. The Chlorine also decomposes the ammonia, and forms muriatic acid by combining with its hydrogen. The other gases generated in the process of putrefaction, detrimental to life, are sulphuretted hydrogen, phosphoretted hydrogen, and carburetted hydrogen. Chlorine combines with one or other of the principles of all of these; and, by decomposing them, destroys their sedative influence on the living system, and thereby renders them innocuous.

In considering the process adopted by Mr. Faraday for disinfecting the Penitentiary at Millbank, it would appear that half a pound of dry chloride of sodium, the same quantity of peroxide of manganese, and one pound of sulphuric acid, would be sufficient for fumigating a building containing 288,714 cubic feet of air.* In applying this gas, some inconvenience arises from its irritant influence on the lungs, and therefore it has been thought to be inapplicable for inhabited apartments: but there is more speciousness than truth in this opinion; and daily experience of its use in the apartments of phthisical patients has completely disproved it. In the belief of this supposition, however, Morveau invented his disinfecting bottle, in which the chlorine is slowly disengaged, and the quantity admitted to escape under the regulation of the attendants in sick apartments. It consists of a strong glass jar, to which a flat ground-glass lid is accurately fitted. The jar is enclosed in wood, and the lid acted upon by a screw, so as to be kept firmly closed, or to

* Journ. of Sciences and the Arts, vol. xviii.

be opened at pleasure. The jar is charged with a mixture of four parts of peroxide of manganese finely powdered and sifted, ten parts of nitric acid of sp. gr. 1.40, and ten parts of muriatic acid of sp. gr. 1.134: the Chlorine is slowly extricated from this mixture; and, being confined in the upper part of the jar by the power of the screw, it acquires an increase of elasticity, and readily issues on the smallest relaxation of the pressure on the lid of the jar. A moderate sized jar of this kind, properly arranged, retains its disinfecting power for many months.

Chlorine may also be employed as a disinfecting agent, as it is spontaneously extricated from solutions of the chloride of lime or of soda. The former of these solutions is the ordinary bleaching liquid, and may be prepared by passing a stream of chlorine through water containing slacked lime suspended in it; the latter by either passing a stream of chlorine through a solution of carbonate of soda, or by decomposing chloride of lime with carbonate of soda*. The best quantities of the ingredients proper for preparing the sodiac solution are 2800 grains of crystallized carbonate of soda dissolved in 1.28 pints of water, through which, in Woulfe's apparatus, is transmitted the chlorine extricated from a mixture of 967 grains of dry sea salt and 750 of peroxide of manganese, acted on by 967 grains of sulphuric acid diluted with 750 grains of water. The gas, before reaching the soda, should pass through a saturated solution of chlorine in water, so as to remove any muriatic acid which may come over. This chlorio-sodiac solution has a pale yellow colour, a slight odour of chlorine, and a sharp saline taste, which leaves an acrid sensation on the tongue. In both of these solutions the chlorine is retained by a feeble affinity: so that, when exposed to the air, it is evolved, and the lime and the soda converted into carbonates; a process which proceeds more rapidly when the air is loaded with putrid effluvia, owing to the great quantity of carbonic acid produced during the putrefactive process. That the evolution of the chlorine depends on the decomposition of the chloride by the attraction

* See method proposed by M. Payen, Quart. Journ. of Science, New Series, vol. i, p. 236.

of carbonic acid from the air is easily demonstrated by passing a stream of carbonic acid through the solution of the chloride of lime: the chlorine is extricated, and the lime precipitated in the form of a carbonate.

The Chloride of Lime was first used as a disinfectant in 1809, by M. Masuyer of Strasburg; but little attention was attracted by the experiments of that chemist, and the chloride remained neglected until 1822, when M. Labarraque introduced it to the notice of the profession. The dry Chloride of Lime may be used with equal advantage as the solution, by exposing it in shallow pans in the places to be disinfected. Under every form it is the Chlorine which is the active agent; and although some individuals complain greatly of the odour of this gas, yet this is a trivial inconvenience when compared with the pernicious property of the effluvia which it is so admirably calculated to remove.

Employed in limited spaces, as in rooms of houses or the wards of hospitals, both the nitric and muriatic acid gases and chlorine possess an undoubted power for destroying the contagious matter of typhus and other infectious fevers: they correct also fœtid odours, and check the putrefactive process. Their employment, however, should not supersede the necessity of white-washing walls, washing clothes, ventilation, and other means, all of which, although they do not neutralize the virus as the gases are supposed to do, yet aid greatly in weakening its force on the system.

c. Caloric.

Although the influence of large fires, in checking the spreading of contagious diseases, had been occasionally experienced, yet the scientific examination of the influence of caloric was not entered upon until Dr. Henry, of Manchester, made his recent experiments. By these he proved that substances, impregnated with the fomites of different contagious diseases, exposed to elevated temperatures, namely, from 200° to 204°, for a considerable length of time, were rendered incapable of communicating the diseases, even when they were clothes worn during the whole period of the contagious

diseases. He enclosed the substances to be disinfected in air-tight canisters, and exposed them to dry heat for the specified time; and he regards this process as superior to the influence of gases, in as much as these may be arrested by compressed materials, while no opposition can prevent the transmission of Caloric. The agent which he employs for conveying the Caloric is steam; and this is passed between the walls of a tinned copper box and an outer case of the same material. The most delicate goods cannot be injured by the application of the degree of heat extricated by this means.

Although the use of acid fumigations—at least those of sulphurous acids produced by burning sulphur, and acetic acid—have been known since the days of Hippocrates, and many favourable effects have resulted from their employment and that of chlorine, yet it is proper, before dismissing the subject, to notice some of the disappointments and disadvantages that have occasionally followed their employment. Thus, at Torgau, Dr. Graefe, Surgeon-general to the Prussian army, tried both the muriatic and nitric acid vapours, and also chlorine, in wards of the Military Hospital containing forty beds each. The fumigations were repeated with closed windows, every two hours, for six weeks. In one ward, two of the attendants were infected and six patients died; in each of the other two wards, three attendants were infected and seven patients died; and a young man, whose sole business it was to diffuse the nitric acid vapour, was infected and fell a victim to the fever.

When the lungs are inflamed during fever, these gases cannot be employed; for, although chlorine, in its diluted state, has been found beneficial when inhaled in the latter stages of phthisis, yet, in the commencement of the disease, when active inflammation exists, it proves injurious by the irritation which it excites; and the same is the case in all pulmonary affections of an inflammatory character*.

* Much information on this important subject may be obtained from "The Reports of a Society for Bettering the Condition of the Poor," vol. i, ii:—Lind on Fever and Infection:—Haygarth's Letter to Dr. Percival:—and Labarraque "De l'Emploi des Chlorures de Chaux et de Sodium."

PART V.

MECHANICAL AGENTS.

It is difficult to offer a correct definition of this division of the Materia Medica, because, although the substances comprehended in it are said to exert no influence on the vital principle, yet we can form no idea of any substance which can be applied to the living body without exciting some sensation in it; consequently, no substance can be strictly termed mechanical which in any degree influences the vital principle. If a quantity of gum or fecula be swallowed, no local effect is perceived in the organ, the gum is in part digested imperceptibly, in part it is taken into the circulation, and, lessening the acrimony of the secretions, produces a salutary effect on the system. Still this substance is not a vital agent.

The term mechanical is intended to express that the articles contained in this division do not produce their effects as remedial agents by any influence which they exert on the vital principle, but by means which closely resemble the agency of active matter on dead or inert bodies. The division contains two classes of medicines only, *Demulcents* and *Diluents*.

SECTION I.

DEMULCENTS.—MEDICAMENTA DEMULCENTIA.

Syn.—*Emollients, Relaxants.*

In defining a Demulcent, it is impossible to avoid some reference to inanimate matter: thence the usual definition is that "Demulcents are substances which diminish the vital tension of tissues and lessen acrimony by lubricating, soften-

ing, and rendering more flexible the solid part of the body." There is no difficulty in comprehending how these effects are produced in bodies devoid of vitality: thus, caloric, within a certain limit, combined with water, or oil applied by friction, enters the interstices of the solid, diminishing the force of cohesion; and the entire density of the part becomes elongated and more flexible. This effect is easily understood in reference to dead matter: for example, if I take a piece of rigid leather and place it, for some time, in tepid water, it loses its rigidity and becomes flexible, or, if I rub it with lard or with oil, the same result ensues, and the explanation is at hand. But, when we reflect that one of the effects of vitality is the preservation of the continuity of the body, in opposition to the efforts of those extraneous matters which constantly tend to its solution, we pause before admitting the same explanation of the influence of Demulcents on the living body. It is, nevertheless, true that warm water, of a temperature not exceeding 98° Faht., and friction with oily and bland fatty substances, render parts flexible which are morbidly rigid, either from contraction or from the deposition of matter foreign to their nature; and consequently they are more easily moved by the influence of the will. How is this to be explained? Does it admit of no explanation, if we refuse to adopt that which has reference to dead or inert matter? or are we to attribute it to the relaxing effect of the substances upon the extreme vessels of the surface, and the propagation of this by *sympathy* to the rest of the body? In reference to the living body, there can be no hesitation in adopting the latter opinion; for, not only is this effect produced by warmth and moisture, but, it is a fact well established, by the use of oily friction in the commencement of the plague, that oil, by relaxing the skin, promotes the excretion of perspiration, in the same manner as the application of warmth and moisture. It is true that the first effect, in both instances, is purely mechanical; for the cuticle possesses little or no vitality, and is composed of scales which are separated from one another either by the application of warmth and moisture or by friction with oily matter; but the subsequent effect must result from the matter, thus admitted to the true skin, being applied

to the sentient extremities of the cutaneous nerves, and, by diminishing their sensibility, decreasing the contractile force of the muscles, and, as I have already stated, propagating this state of relaxation by sympathy to the rest of the body. When the rigidity has been of long standing, and the organization of the part has been, in some degree, changed, then Demulcents, if they act at all, produce their effects in the same manner as upon inert bodies.

But substances that produce a demulcent effect are taken into the stomach and apparently act upon distant organs. A question arises, suggested by the nature of the substances, what effects has digestion upon them ? Undoubtedly, a large portion of almost every Demulcent taken into the stomach is digested; but some part of some of them, at least, escapes this process and is carried into the system. In whatever manner they operate, they are not to be regarded as active medicines, but rather as auxiliaries calculated to do no more than palliate certain symptoms or to afford nutriment to the body.

Almost all Demulcents are inodorous and have a mawkish taste. In persons of delicate habits, in whom the digestive organ in particular is in a weakened or atonic state, Demulcents, long continued, render them paler, more flabby, and more languid than before ; but, in those of vigorous habits, or in ordinary health, they produce no visible effect: we must, therefore, judge of their internal power by their external effects.

Demulcents may be divided into two sections ; the *first* comprehending those which are supposed to act medicinally, the *second* those which are used dietetically. Substances used medicinally, which produce demulcent effects upon the body, are obtained from the animal and the vegetable kingdoms of nature. As far as I know, there is no Demulcent of an inorganic or a mineral nature. The Animal Demulcents may be arranged under three general species—gelatin, cetine, and wax: the vegetable are—gum, mucus, cerasin, sarcocoll, fixed oil, and fecula. The remarks upon each of them may be brief.

TABLE OF DEMULCENTS.

A. SUBSTANCES MEDICINALLY EMPLOYED AS DEMULCENTS.

* *Animal.*

a.—Gelatine—procured from			
Horns—Cervus *Elephas*	1.	7.	Ruminantia.
Sound—Accipenser *Sturio.*	4.	2.	Chondropterygii.
b.—Cetine—from			
Physeter *Macrocephalus.*	1.	8.	Cetacea.
c.—Wax—produced by			
Apis *Mellifica.*	4.	12.	Insecta Diptera.
** * Vegetable.*			
d.—Gum—exuded by			
Acacia *Vera.*	23.	1.	Leguminosæ.
——— *Senegalenis.*	—.	–.	———
Feronia *Elephantum?*	10.	1.	Aurantiaceæ.
e.—Mucus—procured from			
Roots—Althæa *officinalis.*	16.	8.	Malvaceæ.
Malva *sylvestris.*	—.	–.	———
Leaves--Gmelina *parviflora?*			
Seeds—Linum *ussitatissimum.*	5.	5.	Lineæ.
Pyrus *Cydonia.*	11.	5.	Rosaceæ.
f.—Cerasin—exuded by			
Astragalus *Gummifer.*	17.	4.	Leguminosæ.
Prunus *cerasus.*	12.	1.	Myrtaceæ.
g.—Sarcocoll—in			
Roots—Glycyrrhiza *glabra.*	17.	4.	Leguminosæ.
h.—Fixed Oil. *(Animal.)*			
Fat — Ovis *aries.*	1.	7.	Ruminantia.
Sus *scrofu.*	1.	6.	Pachydermata.
(Vegetable.)			
Fruits—Amygdalus *communis.*	12.	1.	Amygdaleæ.
Oleæ *Europeæ.*	2.	1.	Oleineæ.
Coccus *Butyracea.*	1.	1.	Palmæ.

B. DEMULCENT SUBSTANCES WHICH ARE DIETETICALLY EMPLOYED.

a.—FECULA—from

Roots—Maranta *Arundinacea.*	1.	1.	Marantaceæ.
Plant—Cetraria *Islandica.*	24.	3.	Lichenes.
Bulbs—Orchis *Mascula.*	20.	2.	Orchideæ.
Pith — Sagus *farrinifera.*	1.	1.	Palmæ.
Cycas *circinalis.*	1.	1.	———
Seeds—Triticum *hybernum.*	3.	1.	Gramineæ.
Avena *sativa.*	–.	–.	———
Hordeum *distichon.*	–.	–.	———

* ANIMAL PRODUCTIONS USED AS DEMULCENTS.

a. GELATIN.

Gelatin is found in some of the animal solids, as skin, membranes, tendons, cartilages, and bones of land animals, and the sound or swimming-bladder of fishes. It is a semi-transparent, brittle substance: it dissolves in cold water; but in hot water the solution is more easily affected; and, on cooling, it assumes a tremulous appearance. If in this state it be agitated with cold water, a complete solution takes place.

Gelatin, when freed from water by evaporation, so as to become brittle, is not susceptible of change, and may be kept for any length of time; but, when it is united with so much water as to render it tremulous, it soon undergoes decomposition, exhales a fœtid odour, and putrefaction takes place. Exposure to the air is not necessary to effect this change in Gelatin more than in any other animal substance. It is not easy to explain this process; but it would appear that the affinities of the elements of the Gelatin, which is a vital product, are such as tend to separate these elements when this substance is detached from the living body, and placed under circumstances favourable to the operation of those affinities uncontrolled by vitality. For our purpose, it is sufficient to know that this change takes place under the circumstances described; and therefore Gelatin, for medicinal use, should always be kept in the dry state. Dry Gelatin, when exposed

to a high temperature, first whitens, then shrivels, and is carbonized: tremulous Gelatin first melts before it undergoes these changes.

When tincture of galls or any astringent vegetable solution is dropped into Gelatin, in solution, an insoluble precipitate takes place; this is a compound of Gelatin and tannin. It is this combination of the astringent matter of vegetables with the Gelatin contained in the skin that produces leather. Gelatin, like gum, renders oils miscible with water, forming emulsions.

Alcohol and ether also separate Gelatin from the water of its solution; and it is insoluble in these fluids: in a thin solution, however, of Gelatin, neither alcohol nor ether produces any obvious change. All the mineral acids decompose Gelatin. When chlorine gas is mixed with a solution of Gelatin, a white solid matter, in filaments, is separated; which Bouillon la Grange has named oxygenized Gelatin; but the nature of this change is unknown. The alkalies, assisted by heat, dissolve Gelatin, but do not produce soap, as with the oils and fat. None of the earthy salts, with the exception of baryta, precipitate a solution of Gelatin. Phosphate of soda causes a slight milkiness in the solution. Among the metallic salts, nitrate of silver precipitates the solution of Gelatin. Bichloride of mercury is said, by Dr. Thomson, to cause a copious precipitate; but his experiments were made with common glue, which, being made from hoofs, always contains albumen, which is copiously thrown down by the bichloride; but a solution of one part of Gelatin in 100 parts of water is not affected by it. Persulphate of iron throws down a few yellow flakes.

According to the analysis of Gay-Lussac and Thenard, the components of Gelatin are — carbon 47.881, + oxygen 27.207, + hydrogen 7.914, + azote 16.998, = 100.000. Such are the chemical characters of Gelatin; but these differ in some particulars, according to the nature of the substances which yield it.

HARTSHORN SHAVINGS. *Cervus Elaphas:—Cornu.* L. E. D. —The horns as well as the hoofs of the greater number of

animals consist of albumen; but those of the stag closely resemble bone, consisting chiefly of phosphate of lime, with a considerable quantity of gelatin.

The stag is a native of the whole northern parts of our hemisphere. It sheds its horns annually, about the end of February. They are reproduced in a soft, tender state, full of blood-vessels, and covered with a downy cuticle, which they lose by degrees as they increase in size, until they become hard, compact, and bony. It is supposed that the number of the points of the horns indicates the age of the animal; but, after the eighth year, this is very uncertain.* Pure Hartshorn Shavings, which are formed by rasping down the internal white part of the horn, yields to water, by decoction, twenty-seven parts of gelatin in every hundredth parts of the horn. The gelatin which they afford is inodorous and insipid, and has all the chemical properties of pure gelatin. As sold for medicinal use, these shavings are mixed with bone shavings, which may be distinguished by their greater degree of brittleness: but the adulteration is of too little consequence to merit attention.

The retention of Hartshorn in the list of the Materia Medica is the relic of a period of inert practice. The gelatin it yields is a light and sufficiently nutritious article of diet for the sick and the convalescent; but this very quality renders it useless as a medicine.

ISINGLASS. *Ichthyocolla.*—The sounds of the Perch, some species of the Cod, and a few other fishes found in the waters of this island or upon its coasts, form Isinglass. The Sturgeon, Acipenser *Sturio*, from which the best is prepared, is caught in the rivers of Russia, occasionally in those of this country, in the Nile, and in the Caspian Sea.

The Isinglass is the prepared sound or swimming-bladder of the Sturgeon. It is taken from the fish, slit open, well

* A curious fact attending the growth of the Stag's horns is worthy of notice, in a physiological point of view. When the animal is castrated, if this is performed at a very early age, the horns do not grow; if, at a later period of life, the horns do not alter nor fall off during the life of the animal. I have a pair of horns in my museum, presented by my friend, Sir F. Shukburgh, Bart., produced on a castrated deer on his own estate.

washed, and freed from the thin membrane which covers it; then beaten, exposed to stiffen a little in the air, rolled, and fixed in a peculiar shape by means of wooden pegs, or folded into leaves like a book, or simply dried without any care. The best Isinglass is generally that which is rolled up and called *staple;* the next best kind is the *book Isinglass:* there is little demand for the inferior kind, which is used to adulterate the other kinds. Good Isinglass should be dry, whitish, nearly pellucid, and inodorous. One hundred grains of it should afford ninety-eight of matter soluble in water, and scarcely two parts of solid, insoluble matter, which consist of phosphate of soda and phosphate of lime. A coarse kind of Isinglass has lately been imported into this country. I have not tried its solubility; but its exterior is not very promising.

The same objections apply to Isinglass as to gelatin obtained from hartshorn; and we can only wonder that, while this gelatin is expunged from the last edition of the London Pharmacopœia, the hartshorn is suffered to remain. It was formerly regarded as an antacrid, lubricating, and incrassating remedy; but the experience of modern medicine has demonstrated it to be worthless as a remedy.

As a nutrient, a solution of Isinglass, acidulated with lemon juice, and, when it is admissible, flavoured with wine, is a very proper and agreeable food for the convalescent; but it is much less nutritive than the muscular parts of animals, and also less easily digested. In animal broths, gelatin is combined with oil; and if we can regard gelatin at all in the light of a remedy, it is in this form; in which it is ordered as an enema in the tenesmus of dysentery, and in ulcerations or abrasions of the lower portion of the intestinal canal.

b. Cetine.

This name was given by Chevreul to the white crystalline scales deposited from alcohol boiled on pure Spermaceti.

Spermaceti is an inflammable substance, occurring in white, pearly, crystalline plates, brittle, soft, and unctuous: at 210° Faht. it softens and melts; but crystallizes again when cooled. It is insoluble in water, but soluble in 13 parts of boiling alcohol, from which, as the solution cools, it is deposited in

brilliant, talc-like scales. It is also soluble in fixed and volatile oils; but it separates from the latter as it cools. When distilled repeatedly, it is partially decomposed and becomes liquid, like oil; and, by a farther repetition of this process, a brown acid liquid is produced. It forms a soap with the pure alkalies: the acids have scarcely any action upon it. In the head of the Phyceter *Macrocephalus*, or white whale, the Spermaceti is contained in two principal cavities, besides several smaller ones, which are covered with several teguments:—1, the skin; 2, a layer of fat; and, 3, a black membrane containing large nerves. The larger cavities are subdivided, as it were, into smaller chambers, each of which is again subdivided by vertical membranes resembling the lining pellicle of the egg of the hen. The Spermaceti is always fluid during the life of the animal. The lowest cavity contains the purest Spermaceti. The Spermaceti is also distributed all over the animal by a peculiar system of tubes, the main trunk of which is improperly termed the *spermatic* vein.

Spermaceti, although not so abundant as in the white whale, yet is found in all the other Cetaceæ; from the oil of which it is deposited in considerable quantity; and this is also the case, in a more moderate degree, in the oil of almost all fishes, whether breathing by lungs and mammiferous, or breathing by gills.

The quantity of crude Spermaceti which is dug out of the head of an ordinary-sized whale is seldom less than twelve large barrels-full. The oil is separated from it by dripping; and, in this state, the Spermaceti is sent home to England. It has a yellow, unctuous appearance, and a nauseous odour, and is unfit for medicinal use until it is purified.

Spermaceti, although more employed as a Demulcent, is scarcely more valuable as a remedy than gelatin. It is readily digested in the stomach in the same manner as animal fat, and is converted into chyle with equal facility as any other animal matter. From some fancied healing virtues, which it was supposed to possess, Spermaceti was formerly regarded as highly beneficial in all affections of the chest, the kidneys, and the uterus; and, even in the present day, from some feelings of a similar kind, it is often prescribed as a

vehicle for preparations of opium, and some sedatives after child-bearing. It is not for us to perpetuate error; and, as an internal remedy, experience has decided against the claims of this substance.

c. WAX.

Wax is both an animal and a vegetable production. It was long supposed to be merely collected by the bee from the pollen of flowers, and then wrought up by the insect into the regular and beautiful hexagonal cells which characterize the honeycomb; but this is a mistake: pollen does not yield wax, and it has been ascertained that bee's wax is a secretion of the insect, and the production of the glands termed wax-pockets, which are seated under the wings on each side of the insect. From the observations of Huber, it appears that sugar is essential towards the formation of wax, and that bees, supplied with sugar only, and shut up in the hive, manufacture Wax in the same manner as those bees which enjoy their freedom, and range from flower to flower. The flower yields the honey which the bee eats; and from this, after it undergoes animalization in the stomach of the insect, and is deposited in the cell of the comb, the Wax is produced. But Wax, as above stated, is also formed by the vegetable œconomy, and is found as an abundant excretion of many plants. What is called the bloom on many leaves and fruits, is an excretion of Wax: the seeds of the Myrica *cerifera*, an American tree, is so thickly encrusted with Wax, that it is separated from them for the purposes of commerce; and the trunk of a South American palm, the Ceroxylon *Andicola*, is thickly covered with Wax. It is found also in some vegetable essential oils.

Wax, as it is obtained from honeycomb, is of a dark-yellow colour, owing to its admixture with some honey and what is termed bee-bread. It has an aromatic odour, owing to the same admixture; for pure Wax is inodorous and insipid. It is purified by being drawn out in ribbands, and afterwards exposed to the light and air. By this process the Wax is whitened; and is then melted and thrown into moulds, in which it acquires the round and disc-like shape, in which

pure Wax is usually found. By this process not only is the colour discharged; but, as purified Wax is of a less specific gravity than yellow Wax, we may conclude that something is lost during the bleaching of the Wax. Chlorine bleaches it when applied to it in combination with water.

Unbleached or yellow Wax is brittle, but not hard, is ductile and unctuous, and does not adhere to the fingers. When cut, it presents a peculiar surface, which is termed waxy-lustre: its sp. gr. is 0.96; it fuses at 150° Faht. and boils at 300°. Wax is insoluble in water, and only partially soluble in boiling alcohol; and the greater part of the Wax is precipitated as the solution cools: what is held in solution is precipitated by water. Both the fixed and the volatile oils dissolve Wax when aided by heat. With the former, it constitutes the well-known substances termed cerates and ointments. Boiled with the fixed alkalies, it forms a soap, which is a simple combination of the Wax and the alkali; for when an acid is added to the saponaceous compound, the Wax is separated in its natural state. The acids scarcely act on Wax.

According to the experiments of Dr. John, when bees-wax is treated with boiling alcohol, it is separated into two distinct substances, *cerine* and *myricine*. The former is of the consistence of Wax, of the same specific gravity as water, melts at 108° Faht., is insoluble in water and in cold alcohol, but soluble in boiling alcohol, precipitating, however, as the solution cools. *Myricine* is of the consistence of wax, somewhat glutinous, and of less specific gravity than water, insoluble in water and in alcohol and ether, even when hot. One of these substances gives the brittleness to Wax, the other its unctuosity. According to Dr. Ure, the ultimate components of Wax are 80.4 of carbon, 11.3 of hydrogen, and 8.3 of oxygen, or 13 prop. of carbon = 78, + 11 of hydrogen = 11, + 1 of oxygen = 8, making the equivalent 97. The supposition, therefore, that Wax is an oxidized fixed oil cannot be correct, as by this analysis the Wax contains less oxygen than the fixed oils.

Wax is often adulterated. When very brittle, and the colour of the mass a light grey, inclining to yellow, there is

reason to suspect that it is mixed with peas-meal; when the fracture is smooth, shining, and vitreous, it contains resin, which may be readily detected by putting a small quantity of wax in alcohol: the resin is dissolved whilst the Wax remains unacted upon. An admixture of *tallow* is detected by the exhalation of a disagreeable, suffocating smell when the Wax is melted.

Wax is employed as a Demulcent in the tenesmus of dysentery, combined with soap and mucilaginous solutions; but it cannot be said to possess much demulcent virtue. The best formula for prescribing it is that of Dr. Monro. He orders three drachms of *bees'-wax*, one drachm of Castile soap, and one fluid ounce of water, to be melted over the fire in a tin vessel, stirring them until they are perfectly mixed. The mixture is then to be poured into a mortar, and gradually incorporated with a pint and a half of water, and two ounces of syrup of marsh mallows.

The dose of this compound is two or three table-spoonfuls, repeated at the intervals of three or four hours. It has been recommended in diarrhœas; but, if these are passive or depend on simple debility of the viscus, such a composition as this is must increase the evil; and, if they arise from inflammation or any other active cause, it is not easy to see how such a remedy can prove beneficial, although it is not difficult to conjecture that it would prove hurtful if it passed unaltered to the diseased surface.

** VEGETABLE SUBSTANCES USED AS DEMULCENTS.

a. GUM.

Gum is one of the earliest of the vegetable secretions, being the first change of the sap into a distinct substance. It exudes from the bark of certain species of trees, and almost all of them have astringent barks. The general characters of Gum in the dry state, that in which we are most familiar with it, are semitransparency, brittleness, insipidity, inodorousness, and solubility in water. When very pure, it is nearly colourless; but some of the varieties are yellowish.

Its specific gravity is greater than that of water, being 1.355. It does not undergo any change when dry and kept in a dry place; but, when moist, it becomes mouldy. Exposure to the light blanches it. Heat softens and swells it, but it does not melt; on the contrary, it is charred, emits a bluish flame, and a light charcoal remains in the retort. If Gum be submitted to the action of a very high temperature, it is consumed, leaving a white ash, which consists chiefly of carbonate of lime and carbonate of potassa. The solution in water does not undergo any material change; for, when the water is evaporated, the Gum is obtained unaltered. When it is long kept in this state, if the mucilage it forms be not too thin, it will keep unaltered for years; but, if thin, it acquires an acetic odour and taste, and becomes mouldy on the surface.

Gum combines with some of the metallic salts, causing precipitates. With acetate and subacetate of lead, it forms a copious coagulum, which consists of 38.25 parts of oxide of lead and 61.75 of Gum; the acetic acid being left in the water.

Gum unites readily, and with no very obvious change, with all the alkalies when unaided by heat; but, when liquid pure potassa is employed and the mixture heated, it converts the Gum into albumen; and, when the watery part is evaporated, the residue has all the characters of albumen treated with heat, and is equally insoluble. M. Raspail, who first remarked this result of the alkali on Gum, asserts that the alkali actually converts the Gum into true albumen, which he conceives to be a compound of Gum and potassa, even when it is the product of animals. It certainly closely resembles animal albumen in many of its properties. Thus, when exposed to a high temperature, it is, like albumen, incinerated with difficulty; whereas, nothing is so easily carbonized as Gum. In fact, according to Raspail, it is the alkali which, both in the albumen and the alkalized Gum, resists the incineration; it forms a layer on the surface, intercepting the contact of the oxygen, which, under ordinary circumstances, oxidizes and vaporizes the carbon. This is certainly a very remarkable fact, and demonstrates the ex-

istence of an affinity between vegetable and animal products, which could not, a priori, have been expected.

The mineral acids act powerfully upon Gum ; the sulphuric decomposes it, resolving it into charcoal, tannin, water, and acetic acid ; the muriatic produces a brown solution, which lets fall a charry matter, and the Gum approaches to sugar in its properties ; but the most remarkable effects are produced by nitric acid. If this acid, added to Gum, be slightly heated until a solution take place, and a little nitrous gas be exhaled, the solution on cooling deposites mucic acid ; and malic acid is formed at the same time. If a greater quantity of acid and longer-continued heat be employed, the Gum is changed into oxalic acid. In this process, the first operation of the action of the acid is to supply a sufficiency of oxygen to convert the Gum into sugar ; upon which the acid then acts, and forms oxalic acid.

When alcohol is poured into a solution of Gum, it precipitates the Gum, by attracting from it the water of solution ; at least this is the explanation of the phenomenon given by the chemists.

Gum is insoluble in oils ; but, when triturated with these, it renders them miscible with water—a fact which is very useful in prescribing these unctuous bodies.

When Gum is exposed for a long time to a temperature of 212°, it loses, according to Dr. Prout, all the water not essential for its composition ; but, even in this state, it consists of carbon 41.4, and water 58.6, in 100 parts. According to the analysis of Gay-Lussac and Thenard, 100 parts of Gum consist of 50.84 of oxygen, 42.23 of carbon, and 6.93 of hydrogen. If these analyses be correct, we may with much probability suppose that Gum is the consequence of the decomposition of water in the vegetable system, and the union of its components with the carbon taken in with the fluid of the soil in a state of solution. Be this as it may, it is the result of the vital power of the plant operating in determining the affinities of those ultimate principles which in various proportions constitute the basis of all vegetable bodies.

Gum is the production of a great variety of plants.

GUM ARABIC. *Acaciæ veræ Gummi.* L. E. D.— The

Acacia yielding this gum grows on the Atlas mountains, and at Bled-eljerrede. This plant belongs to the class Polygamia Monæcia of the Linnean system, and to the natural order Leguminosæ. This plant was formerly named *Sant* by the Egyptians. It is a low tree, of a hard, withered aspect, with a stem covered with a grey bark, from which the gum exudes in a soft, semifluid state, and hardens in the atmosphere without losing its transparency. The gum, when first collected, which is about the middle of December, has a faint smell; and, after being stowed in the warehouses, cracks spontaneously. The best Gum Arabic exported from Morocco is procured from the province of Sase and that of Abda. It is often mixed with gum senegal, which is the production of another species of Acacia.

Good Gum Arabic has a very pale straw colour, breaks with a vitreous fracture, is transparent, inodorous, insipid, and feels viscid in the mouth. It is, in general, in round or irregularly cracked pieces. When dissolved in water, a small portion of insoluble matter is left, which contains nitrogen.

Besides the general components of gum, this species contains a small portion of gluten, which is detected by rubbing the gum with a spirituous solution of guaiac, which evolves a blue colour if gluten be present; or even by mixing the mucilage with the tincture of guaiacum, and allowing the mixture to stand exposed to the air for some time. The change is gradual, first to pale green and ultimately to a deep cerulean blue. This is perhaps the most perfect test of the distinction between gum and mucus; next to this is the precipitate caused by silicated potassa; and, lastly, the effects of alcohol, which precipitates gum in white opaque flakes, owing to its abstracting the whole of the water from the gum, whilst it merely coagulates mucus. Such are the distinguishing features of gum and mucus. Cherry-tree Gum belongs to neither, but approximates to tragacanth. Gum Arabic is often mixed with the Gum of another species of Acacia, a native of Hindostan, Ceylon, and also of Arabia, the Acacia *Arabica* of Roxburgh. It so closely resembles the Acacia *vera*, that Linnæus confounded it with that plant. It grows to a

pretty large tree, on a low stiff soil, and is in flower the greater part of the year. The Gum is collected in the dry season, and is used as an article of diet by the natives, mixed with the seeds of the sesamum, after the oil is expressed from them. Like the other species of Acacia, the bark and the pods are employed as astringents for tanning leather, dying various shades of brown with salts of iron and for the preparation of ink. Another species of Gum, which resembles that of the Acacia *vera* in its properties, is obtained from the Feronia *Elephantum*, or wood apple tree of Roxburgh, a native of the woods and mountainous parts of India, and of Ceylon, near Colomba. It belongs to the natural order Aurantiaceæ. The Gum exudes from wounds made in the bark; and is so pure and transparent that Roxburgh says "Mr. Smart, the miniature painter, told him it exceeded every thing he had ever seen for mixing with his colours*." The fruit is eaten and the Gum employed for medicinal purposes all over India. It is never brought to England as an article of commerce.

Another variety of Gum used in India is Gum *Kutura*. It was at one time imported in considerable quantity, under the notion that it would answer the same purposes as tragacanth; but, as it did not answer as a substitute, it ceased to be imported. It is the produce of the Sterculia *Urens*.

The demulcent properties of Gum were very early known. Dioscorides mentions that it obtunds the acrimony of medicines with which it is mixed. If we enter into the examination of the effects of the digestive powers of the stomach on Gum, we shall find that, unless it be combined with a bitter, it is seldom digested, and not unfrequently passes through the stomach and bowels unaltered. This, in a great measure, secures its enveloping power as a Demulcent. In opposition to this opinion, may be stated the fact mentioned in Hasselquist's voyages, that a large caravan of Abyssinians would have starved if they had not discovered a stock of Gum Arabic amongst their merchandize—on which alone 1000 persons subsisted for two months. Whole towns of negroes in Africa, also, subsist upon Gum in seasons of

* Plants of the Coast of Coromandel, fol. vol. ii, p. 20.

scarcity; and the Arabs who collect the Gum subsist upon it during the period in which they are thus employed*. Yet dogs, as an experiment of M. Majendie proves, soon perish if fed only on Gum. The animals quickly lose flesh; they become dull, and have no relish for food in the second and third week, and generally die about the 32nd or 33rd day of the experiment†: but it should be recollected that the dog is a carnivorous animal.

The effects of Gum as a Demulcent is well confirmed; it is useful in the inflammatory stage of gonorrhœa; in strangury from the absorption of cantharides and other acrid matters which pass into the circulation and are excreted by the kidneys; in catarrh, to sheath the fauces; and as an enema, combined with milk or other animal juices, in tenesmus. In whatever form Gum is administered, it ought to be thick, so as to admit of dilution in the juices of the stomach, if we are to expect any benefit from its employment as a Demulcent.

e. MUCUS *(vegetable).*

This principle is more generally extended over the vegetable kingdom than Gum. It is found in the roots, leaves, and seeds of many plants; and, in its purest state, greatly resembles a solution of gum in its physical properties. Dr. Bostock first pointed out two of the distinctions which mark the difference between Gum and Mucus. I have already mentioned another, tincture of guaiac.

Mucus varies according as it is procured from different plants; and parts of plants.

* ROOTS.

1. THE ROOTS OF MARSH MALLOW. *Altheæ officinalis radix.* L. E. D.—This plant, which belongs to the natural order Malvaceæ, is indigenous; the root is perennial, and the herbaceous part annual. It is cultivated both in Germany and in France, for medicinal purposes, and is imported into

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* Lind on the Diseases of Hot Climates.

† Majendie's Elemens de Physiologie, &c.

this country. The root is fusiform, white in the interior, and covered with an ash-brown epidermis.

Every part of the plant abounds with mucus; but it is most plentiful in the roots. When these are steeped in cold water, the mucus alone is extracted; but, when they are boiled, the mucus is mixed with fecula: this is demonstrated by tincture of iodine, which produces no effect on the cold infusion, but gives a beautiful blue colour to the decoction. According to the analysis of M. Bacon, of Caen, Marsh Mallow roots contain—gum or mucus, sugar, fat oil, starch, and a peculiar crystalline matter which he named *altheine*, resembling asparagine or glycyrrhizine, malic acid, albumen, several salts, and lignine.* The officinal preparations of this root are decoction and syrup. On the Continent, a demulcent lozenge is prepared with it, named *Pate de Guimauve.*

** LEAVES AND FLOWERS.

1. THE LEAVES AND FLOWERS OF COMMON MALLOW. *Malvæ Sylvestris folia et flores.* L. E.—This plant is found in almost every quarter of the globe; it is a common weed on the sides of roads, and round fields, in this country.

All the parts of the plant yield mucus; and, when boiled, tincture of iodine demonstrates the presence of starch in the decoction. The flowers being delicate tests of the presence of alkalies and acids, any addition of these substances to the decoction gives it a green or red colour, as the one or the other is used. The decoction is employed as a fomentation in abrasions, and as a glyster in dysentery.

2. An East Indian plant, Gmelina *parviflora*, contains so much mucus, that a thick viscid mucilage, which may be used as gum, is obtained by steeping a few of the leaves in cold water for eight or ten hours.

*** SEEDS.

1. LINSEED. *Lini Ussitatissimi Semina.* L. E. D.—The Lint plant, belonging to the natural order Lineæ, of which it is the type, is generally cultivated in Britain; but it originally came from the banks of the Nile. The seeds used

* Journ. de Chim. Med. t. ii, p. 551.

in this country are imported chiefly from the Baltic. The plant is readily distinguished by its slender, smooth, round stem, seldom exceeding two feet in height; its small, sessile lanceolate, narrow, alternate leaves; its loose panicle of blue-streaked flowers; and its globular capsule terminated with a spine, containing, in five cells, many flat, elliptical, mahogany-brown, shining seeds, with white, oily cotyledons.

The mucilage resides in the testa of the seeds, one ounce of which, infused in ten fluid ounces of water, forms a colourless, viscid mucus, which is coagulated by alcohol, subacetate of lead, and permuriate of tin; but produces no effect on silicated potassa or the salts of iron; nor is a precipitation caused by decoction of galls. This mucus soon gets ropy and spoils.

M. Vauquelin examined this mucilage, and found it to consist of gum, combined with an azotized matter, acetic acid, acetates of potassa and lime, sulphate and muriate of potassa some phosphates, and silex.

2. Quince Seed. *Pyri Cydoniæ semina.* L.—This plant, which belongs to the natural order Pomaceæ, is a native of Crete. The testa of the seeds abound with mucus, which is readily abstracted by boiling water, an ounce of them being sufficient to render a pint of water viscid. When the seeds are boiled, besides the mucus, the decoction contains malic acid and fecula; on which account the mucilage very rapidly ferments. The acids and the metallic salts coagulate the mucus of Quince Seed, and, consequently, these substances are incompatible in prescriptions with it. The decoction is the officinal preparation.

All the varieties of mucilage which have been described, with the exception of that procured from the leaves of the Gmelina *parviflora*, were well known to the ancients. The mucilage of the linseed, in particular, on account of its cheapness, has always been in common use. In preparing it, the custom is to boil the seeds in water, but this is unnecessary, and, indeed, it is injurious, as some of the fixed oil contained in the cotyledons is extracted, and gives a nauseous taste to the mucus. In all visceral inflammations, particularly in that of the kidney or the bladder, in gonorrhœa, ardor urinæ, and

tenesmus, the mucilage of linseed has been found very useful, whether administered by the mouth or exhibited as an enema. Dioscorides particularly notices the mucus of the marsh mallow in affections of the urinary bladder: it is procured by slicing the roots transversely, and boiling them in water, in the proportion of two ounces of the root to a pint of water. Both the leaves of the Althæa and those of Malva, when well boiled, form excellent emollient cataplasms in abrasions, and in cutaneous eruptions, such as impetigo, in which a sharp ischerous discharge takes place. It forms an excellent vehicle for the hydrocyanic acid, as an external application when there is much irritation in impetigo. The mucus of the quince is much employed in aphthous states of the mouth, and in inflammation of the eye, when the lachrymal discharge is sharp and acrid, and as an enema in tenesmus and chronic diarrhœa.

These mucilages are less useful, however, than the mucilage of gum arabic, in as much as they are more digestible, and therefore less likely to pass into the system undecomposed; this is especially the case with the quince mucilage, which contains a bitter principle that aids the influence of the stomach upon the mucus.

f. CERASIN.

Cerasin derives its name from *Cerasus*, the specific name of the Prunus, which yields the common cherry; this substance being contained in the gum which exudes from the bark of the cherry-tree. It is, however, procured in very small quantity from this source, and is besides very impure: the greater part of that which is used in medicine and in the arts is brought from Persia.

The usual appearance of Cerasin is not unlike that of gum, except that it is in vermicular fragments, less transparent than gum, not so easily pulverized, but equally insipid and inodorous. It is, strictly speaking, not soluble in cold water; but imbibes the water, swells, and forms a thick, gelatinous mixture: if the cold water, however, be acidulated with any of the mineral acids, a portion of the Cerasin is dissolved. In boiling water, the gelatinous mixture of Cerasin and wa-

ter is dissolved ; but, as the liquid cools, the gelatinous part is again precipitated: if the acidulous mixture, however, be heated, nearly the whole is permanently dissolved. According to Bucholz, a German chemist, Cerasin consists of 57 parts of a matter resembling gum, and 43 parts of a peculiar matter, insoluble in cold water, although it imbibe that fluid and swells like a sponge; but it is soluble in boiling water, in which it forms a permanent mucilage. According to the analysis of Guibourt, however, the portion dissolved in cold water differs from gum in collecting into an opaque mucous mass, when it is precipitated by alcohol, which is not the case with gum ; whilst the insoluble portion, he says, has some affinity to starch in striking a blue colour with tincture of iodine. This latter portion has been named Bassorine, from being found abundantly in *Bassorah* gum. From what I have said of the effect of alcohol, the acids, and iodine, it is probable that Cerasin is a compound of mucus and fecula ; the former constituting the portion soluble in simple water, the latter that which requires the aid of acids for its solution.

If a solution of gum arabic be poured into a solution of Cerasin, no union takes place ; but, on the contrary, the Cerasin separates sooner from the water than it would otherwise have done.

Notwithstanding the insoluble nature of Cerasin, an homogeneous mucilage may be formed by triturating it with pure water in a mortar. This solution is precipitated by subacetate of lead: so far it accords in its characters with mucus; but muriate of tin, which does not affect a solution of mucus, produces a copious precipitate in a solution of Cerasin, in which respect it accords with fecula. Silicated potassa, which precipitates a solution of gum, does not affect the watery mixture of Cerasin ; demonstrating that the soluble part is mucus. Nitrate of mercury throws down a slight reddish precipitate.

Such are the chemical properties of Cerasin, confirming my opinion of its character, that it is a mixture of mucus and fecula. There are three known varieties of Cerasin.

1. TRAGACANTH. *Tragacantha.* L. E. D.—This is almost pure Cerasin. It is the production of a species of Astragalus,

which is supposed to be the A. *Creticus*, a plant which grows abundantly on Mount Olympus and in Ionia and Crete, belonging to the natural order Leguminosæ. Tournefort describes the plant which he saw on Mount Ida, and details the manner in which the Tragacanth is collected; but, notwithstanding the time that has since elapsed, there is still doubt respecting the species of Astragalus which yields this gum-like exudation. The Astragalus *Tragantha* and *Gummifer* of Labillardiere are also supposed to be the plants; whilst some refer it to the Astragalus *verus* of Olivier: perhaps all of them yield Tragacanth.

The greater part of the Tragacanth which is brought to England comes from Persia. Most of the species of the genus Astragalus are low, stunted plants, with closely crowded branches, and numerous long spines which are the petioles of the former years.

The Tragacanth exudes in summer, in more or less abundance according to the heat of the weather, in tortuous filaments or ribands. That which is collected in Persia is sent to Bagdad, Bussorah, and Russia: that which comes to this country is exported from Aleppo.

The qualities of Tragacanth which distinguish it as being good, are whiteness, semitransparency, brittleness, insipidity, and inodorousness. It displays all the chemical properties of pure Cerasin. Although brittle, yet Tragacanth is not easily pulverized, unless during frosty weather and in a heated mortar. The London College orders a compound powder which contains starch—a useless ingredient, as it is not soluble in cold water. Mucilages of Tragacanth are ordered by all the British Pharmacopœias. A drachm of Tragacanth thickens a pound of water as much as an ounce of gum; but the best proportions for internal use are a drachm of Tragacanth to eight fluid ounces of water.

2. Cherry-tree Gum. *Pruni Cerasi Gummi.*—Besides being procured from the cherry-tree, this species of Cerasin exudes from the bark of the apricot and the plum-tree. It is too well known to require any particular description. As it exudes from the bark, it is variously coloured by the other secretions of the bark: thence Cherry-tree Gum, were

it even obtained in sufficient quantity for medicinal and other purposes, is too impure to supply the place of tragacanth. It consists chiefly of Cerasin; and, from the circumstance of Dr. John having discovered this product in Cherry-tree Gum, the whole received from him the name of Cerasin. It displays all the chemical characters of tragacanth, with the addition of a little tannin.

3. THE GUM OF BASSORAH. *Gummi Bassoræ.*—This is the production of an unknown plant. M. Virey, in a paper which he published in the Journal de Pharmacie, has conjectured that it is a species of Mesembryanthemum; but upon what foundation does not appear. It is brought from the neighbourhood of the city of Bassorah; whence its name: but it has, occasionally, been found mingled with the gum arabic of the Coast of Barbary.

The Gum of Bassorah is in irregular masses, of a yellowish hue, less transparent than gum arabic, but more so than tragacanth. It is insipid, and does not produce so thick a mucilage as tragacanth. It swells like tragacanth when put into water; but it does not form a cohesive mucilage, as it appears to be composed of a vesicular matter, which, after it swells in water, separates like little granules, and does not appear to be susceptible of cohesion. This vesicular matter is insoluble in water, is not coloured blue by iodine, but is soluble in water acidulated with nitric acid. Treated with potassa, ammonia is disengaged. If the Gum of Bassora be treated with water, alcohol, and ether, it leaves this substance, which is Bassorine, in a state of purity. As I have already stated, Bassorine enters into the composition of Cerasin. Vauquelin, who has particularly examined this substance, found it in the Gum of Bassorah, and thence named it; Pelletier has found it in *assafœtida*, *euphorbium*, *bdellium*, and *sagapenum;* Braconnot has discovered it in the *bean of St. Ignatius;* and Caventou in opium.

Such are the three varieties of Cerasin which have been employed as Demulcents. The Tragacanth is the only one which is generally used in medicine. As it forms a thicker mucilage than gum arabic, it has acquired the character of being a better Demulcent; but, from its approximation to fe-

cula, I am disposed to think that it is more digestible than gum, and therefore is less demulcent when it is taken into the stomach. As a local Demulcent, it is preferable to mucilage of gum ; but, upon the whole, all the purposes of a Demulcent, whether general or local, are obtained from gum, and, consequently, it is unnecessary to load the list of Materia Medica with other vegetable gums for this purpose.

g. SARCOCOLL.

This is the concrete juice of the Penæa *macronata*, a plant which is a native of Africa. Sarcocoll was known to Dioscorides, who states that it is the tears of a tree which is a native of Persia ; that it resembles the farina of frankincense, is reddish, yellow, and is bitter to the taste; and that it is often adulterated with gum.

It is generally in small yellowish grains, and has a peculiar odour not unlike that of anise-seed. The pure Sarcocoll which the samples of this vegetable matter generally contain does not exceed eight parts in ten ; the other two parts are impurities of various kinds, but chiefly cerasin. Sarcocoll has a sweet taste, which changes to a bitter. The watery solution is viscid. Its solution is precipitated by infusion and tincture of galls. Nitric acid causes a slight effervescence, and throws down a white precipitate. Silicated potass causes no precipitate, but colours the solution of Sarcocoll green, as do all the alkalies. Sulphate of iron slowly forms a precipitate, and subacetate of lead an immediate and copious one. The circumstance of being precipitated by tincture of galls distinguishes Sarcocoll from gum and mucus, and approximates it to starch, which yields a gallo-tannate when treated with hot infusion of galls and allowed to cool.

The extract of liquorice, or Spanish juice, as it is termed, owes its taste and peculiar properties to Sarcocoll. It is obtained from the roots of the Glycyrrhiza *glabra*, a plant belonging to the natural order Leguminosæ. This plant is a native of Syria, but is cultivated abundantly in Spain and in this country. When the plant is three years old, the roots are supposed to be at their perfection ; they are then dug up for use. Dr. Russel, in his History of Aleppo, informs us

that a decoction of the roots of the liquorice plant is drunk cold in summer, in the manner of sherbet. By decoction, these roots yield the well-known extract liquorice or Spanish juice, This extract is chiefly prepared in Spain, whence it is imported in rolls covered with laurel leaves. It is afterwards refined, and formed into small cylinders, which are glossy, brittle, and break with a vitreous fracture. It consists of mucus, Sarcocoll, or at least a substance which is a variety of Sarcocoll, sugar, and charcoal, which is converted into artificial tannin when the liquorice is dissolved in nitric acid; and when dissolved in sulphuric acid, the charcoal left amounts to one quarter of the weight of the liquorice employed.

The saccharine matter of liquorice is procured in the form of a yellow, transparent, brittle mass, which, when heated, swells, burns with a clear flame, and gives out smoke. The solution of this saccharine matter in water is precipitated by all the acids; but none of the acids appear in the precipitates. Robiquet, who first separated this saccharine matter from liquorice, has named it *Glycyrrhisine.*

As a Demulcent, extract of liquorice is useful for smearing the fauces and allaying the tickling cough which often accompanies catarrh. It is also useful, although in an inferior degree, when taken into the stomach, as it appears to involve there many things that are detrimental to the healthy stomach; as, for example, superabundant acidity. In heartburn, a piece of liquorice often affords very considerable relief.

h. FIXED OILS.

The nature of these oils has been already explained. As an article both of diet and of medicine, one of these oils has been known from the earliest periods to which the history of our species can be traced. As Demulcents, the Fixed Oils, of whatever kind, are rarely given in an uncombined state, although the followers of the doctrines of Broussais, in France, have lately exhibited them in those affections of the viscera which they term gastro-enteric; and it is undoubted that, in their unmixed state, the Fixed Oils are not readily digested, but continue separate from the other contents of

the stomach, and thence are well adapted to act as Demulcents.

When oil is taken into the stomach in a combined state, such as occurs in the productions of nature—in the emulsive seeds, for instance—it is wholly converted into chyme, and of course does not pass the pylorus ; so that it cannot exert any demulcent effect; but when it is not blended with other substances, this is not the case, and it then becomes a useful medicinal agent. Much, however, depends on the manner, and even on the dose, in which it is given ; for oil which, in small doses, acts as a Demulcent, in large doses proves either emetic or purgative. Oil, in its pure state, was formerly given when a gall-stone was impacted in the duct, under the idea that it would operate in relaxing the spasm upon the duct; but, if it operate at all in such a state of the habit, we must refer the benefit to sympathy. It is unnecessary to go over the ground again, as far as regards the character of Fixed Oils in a chemical point of view. The oils, as I have already said, when given as Demulcents, are generally combined with other substances, either by the hand of nature or by art: it is in this latter state that we have now to examine them.

When artificially prepared as Demulcents, oils are generally combined with water, either by means of mucilage of gum or by means of alkalies. With the first, the oil is simply diffused through the fluid in a state of minute division, and the mixture is easily decomposed; with the other, a soap is formed, which is more permanent. In the first state, the oil is more easily digested as it approaches to the natural emulsions, or those formed by triturating demulsive seeds with water. The demulcent power is much diminished by this division of the oil. In the saponacious compound, on the other hand, oil is a useful Demulcent ; and, although I cannot exactly explain the manner in which it produces its effects, experience has sufficiently confirmed its utility as a Demulcent to authorize its recommendation.

The only seed employed for forming emulsions is the almond, the produce of the Amygdalus *communis*.

The almond, as imported into this country, is sometimes

freed from its shell. The best is brought from Malaga, under the title of *Jordan* almonds. The bitter almond, which does not differ much in appearance from the sweet almond, is generally considered as the produce of a variety of the Amygdalus *communis*. Both yield, when expressed, a considerable quantity of bland, insipid, inodorous oil, which, in the cotyledons of the almond, is united with mucus and fecula. This fecula, however, differs from starch, as it is not capable of striking a blue colour with iodine, and is supposed to have properties closely resembling albumen. According to the experiments of M. Boullay, 100 parts of almonds contain 54 parts of a fat oil, 24 parts of albumen, 6 parts of sugar, or rather a saccharine principle, and 3 parts of gum. The albumen which the almond contains is supposed to approximate to the white of egg; but it differs very considerably from that animal substance. A very small proportion of white of egg diluted in water is immediately precipitated by a few drops of the solution of corrosive sublimate, whereas the same substance contributes to the permanence of the almond emulsion. Besides these components of the sweet almond, the bitter almond contains an essential oil, and a portion of hydrocyanic or prussic acid, on which its flavour and odour depend, and a bitter principle.

The emulsion of the sweet almond cannot be regarded as a Demulcent, the quantity either of the oil or the gum being too small to produce a demulcent effect; but it is an useful and agreeable vehicle for other medicines. The emulsion of the bitter almond may be employed in the same manner as that of the sweet almond; and the hydrocyanic acid, instead of being a disadvantage, from the sedative effect which it produces on the nervous system, renders it more useful, in catarrh and similar complaints, than the emulsion of the sweet almond. It must, however, be kept in view that many people suffer from eating bitter almonds, owing to a peculiar idiosyncracy: the skin is rendered highly irritable, and an eruption closely resembling nettle rash appears.

The best known of all the bland vegetable oils is that of the olive, *Olea Europœa*, a plant which is a native of the north of Africa, and belongs to the natural order Oleaceæ. The

value of the oil obtained from the fruit of this plant and the mode of procuring it were very early known; and it was so much prized, that the plant became the emblem of Peace.

The oil is obtained from the ripe fruit: it is gathered in November, and bruised in a mill, which does not crush the nut. The pulp is then pressed in bags made of rushes; the best oil flows first and is termed *virgin oil;* the marc is then broken, moistened with warm water, and again pressed, and an inferior oil is obtained; and, lastly, the marc is broken down, moistened, fermented, and pressed, or it is boiled to an extract, to obtain from it all the oil which it contains. It is necessary to leave the newly-drawn oil at rest for some time, to enable it to deposite a fibrous albuminous matter, which is expressed with the oil.

The oil of olives imported into this country comes chiefly from Lucca and the vicinity of Florence; but the best oil is made in Provence, owing to the great care bestowed in cleaning and garbling the olives. This oil, when pure, has the common characters of the fixed oils; it is the lightest of the fixed oils, its specific gravity being 913; whereas that of almonds and of linseed is 932, and that of the poppy 929. The purer the oil, the lighter it is, and the thinner. Olive oil concretes in a temperature of 10° of Faht.; almond oil remains fluid at a lower temperature; and poppy oil still lower; which differences in the point of concretion enable the adulteration of the oil of olives with poppy oil to be readily detected, by exposing the suspected oil to a freezing mixture, which congeals the oil of olives, but does not affect the oil of poppies. This adulteration may also be detected by mixing the suspected oil with pernitrate of mercury. If the oil be pure, it will become totally consolidated in a few hours; whereas, if it be adulterated, this coagulation will not take place. The admixture of the poppy oil with the oil of olives hastens the rancidity of the oil of olives. Oil of almonds, which is obtained by macerating almonds and then expressing them without heat, is of a paler straw colour than the oil of olives. When first expressed, it is turbid; but it is cleared by filtration through coarse, spongy paper, in a room kept at a rather high temperature.

The oils expressed from the seeds of plants are called *fat oils*. They are all insoluble in water; but form emulsions when triturated with yolk of egg or with gum and water; and it is owing to the presence of mucilage in the cotyledons of the seeds, which yield oil, that they form emulsions when triturated with water. When a thin layer of oil is long exposed to the air, it forms a varnish; and this change occurs rapidly when the layer of oil is exposed upon water in close vessels to the action of oxygen gas: thence we conclude that this change in the oil exposed to the air arises from the absorption of its oxygenous part. But some oils, under these circumstances, do not lose their transparency; and on this account are used in the art of painting under the term *drying oils*.

When the fat oils become rancid, they are thickened, acquire a brown colour, and a disagreeable smell. They acquire, also, acid properties, converting the vegetable blues into red; and sebacic acid and water are evolved. This state has been supposed to depend, in a great degree, on the mucilaginous matter which is pressed out with the oil, and does not separate from it.

The only concrete fixed oil used as a Demulcent is that obtained from the kernel of the fruit of the mackaw tree, the Cocos *butyracea*. It is termed an oil, *palm oil;* but it is, in fact, a vegetable butter. It is used for external purposes only; and in this respect, however, it is not superior to lard and other animal fats, except that it has an agreeable odour.

The demulcent properties of the fat or fixed oils were very early known. They were chiefly employed with the aid of friction; and both Galen and Celsus have left many precepts for their application. The local emollient properties of the fixed oils are much augmented by the addition of caloric in quantity sufficient to produce a temperature between 65° and 98°. In this respect, the action of the fixed oil cannot be regarded in any other light than as a mechanical influence exerted on rigid surfaces without reference to vitality. To its emollient properties we ought to ascribe its effects in promoting the flow of the urine in ischuria or retention of urine, by rubbing it upon the lower part of the abdomen. We cannot account for this in any other manner than by sup-

posing that the relaxing effect which the warm oil produces on the part to which it is applied is communicated by sympathy to the sphincter muscles of the bladder, which, in this case, are spasmodically constricted. Cullen ascribes the benefit chiefly to the friction; but friction alone does not produce the effect which follows friction with warm oil. In noticing this emollient effect of caloric, combined with fixed oil, in ischuria, it is necessary to be careful that the stoppage of urine does not depend upon paralysis of the bladder; as, in that case, the application of warm oil, as an emollient, would be productive of injurious consequences, by adding to the degree of relaxation which is the cause of the stoppage.

B. DEMULCENTS EMPLOYED DIETETICALLY.

Dietetical Demulcents are all varieties of fecula or starch, combined with gluten, albumen, and other vegetable principles. *Starch* is readily distinguished from gum and sugar in its raw state by its opacity, its insolubility in cold water, and its forming a gelatinous mucus when it is boiled with water. Its solution in water soon loses its consistency, acquires an acid taste, and becomes mouldy; it should, therefore, never be kept in this state. It is insoluble in alcohol, which precipitates it from its solution; and it is also precipitated by tincture of galls, subacetate of lead, and barytic water; but the greater part of the metallic salts and silicated potassa do not act on starch. The most delicate test of its presence is iodine; but this acts only in a low temperature, heat decomposing the compound of iodine and fecula, and destroying the colour. The varieties of fecula arranged in the table of Demulcents may be indiscriminately employed for supporting the strength in all diseases of increased action; and in convalescences from acute diseases. Among these varieties, the fecula of barley is the least, that of *salop* the most nutritious, owing probably to its containing a large proportion of saccharine matter.

SECTION II.

DILUENTS.—MEDICAMENTA DILUENTIA.

DILUENTS constitute an order of medicines of great practical importance; for, as they are beneficial in all febrile affections, and as fever is a general accompaniment of almost all diseases, there is scarcely any deviation from health in the treatment of which they are not required. The name of the class refers to the simple fact, that the substances contained in it are intended merely for diluting the fluids of the body. Were this the only result of their administration, very few remarks, indeed, would be necessary for explaining their effects; but their operation involves many enquiries of great interest, some of which have long divided the opinions of physiologists. On this account, in treating of Diluents, I shall enter more into details than might, on a cursory view of the subject, be expected.

It is almost unnecessary to remark that the animal body is a compound of solids and fluids; and that there must be maintained a certain relative proportion of these to constitute that state of system which is denominated *health*.

In a full-grown adult, the solid matter of the body, under which term we comprehend all that substantial part of the frame which is not in constant motion in the vessels, does not amount to more than one-fifth of the whole weight of the body: Richerand makes it one-sixth, and Chaussier only one-ninth. But, independently of the moving fluids, there is a quantity of fluid combined with the solids in so intimate a manner as almost to constitute a part of their substance. The diminution of the fluid part of the body, whether as regards the circulating mass or the solids, is the cause of an uneasy sensation, indicating the necessity of repairing the waste of fluids, which we familiarly term *thirst*. This is a sensation connected with some natural state of the corporeal functions, and altogether independent of the occasional excitement of foreign bodies, although it may be induced by these. In enquiring into the cause of thirst, as far as is necessary for our subject, we must distinguish *true* or *sponta-*

neous thirst from that demand for a certain supply of liquid which is the result of repletion of the stomach, and the cause of our drinking at our ordinary meals. It is not this *alimentary thirst*, if we may so term it, that is to occupy us at this time. True thirst occurs when we have been some time without taking drink; when the system has been greatly excited, whether by corporeal or mental causes; when acrid substances, particularly saline bodies, have been taken into the stomach; and in every condition of the system, from whatever circumstance it may proceed, which favours the excretion of fluids—as, for example, perspiration, diarrhœa, and diuresis.

The immediate cause of thirst appears to be a dry state of the mouth and fauces; owing to the mucus which covers these parts becoming thick and viscid. This may arise from the absorption of the fluid parts of the saliva; for it appears to be necessary, for the due performance of the functions of the palate and the tongue, that the mucus should possess a certain degree of liquidity.

It is proper to observe, however, that some physiologists regard the sensation of thirst as altogether independent of any dryness in these parts, and contend that it is sympathetic of an uneasy state of the stomach. However this may be, the sensation is indicative of the necessity of a supply of fluid to the system generally; for, although thirst may be momentarily assuaged by wetting the mouth or holding a thin fluid in it, yet it can only be effectually and permanently relieved by conveying into the stomach a quantity of fluid sufficient to supply the deficiency. This supply is termed *dilution*, from an idea that the liquid passes into the blood and renders it thin; thence the fluids themselves, which are taken under these circumstances and with this view, into the stomach, are termed *Diluents*.

It is proper to observe, however, that thirst is not always indicative of a deficiency of fluids in the circulating mass; and that the tongue and fauces are found to be occasionally dry and harsh, and yet the sensation of thirst is absent. Some individuals never experience the sensation of thirst. Sanvage mentions a member of the Academy of Toulouse

who never thirsted, and passed whole months of the hottest weather without drinking. It is well known that many warm-blooded animals—as mice, quails, and parrots—drink very little*. In general, however, thirst is indicative of diminished fluidity of the blood; and, when the sensation is not assuaged by taking liquids into the stomach, or by moistening the mouth with them, or by applying them to the surface, the torment which it induces occasionally amounts almost to phrenzy; and on every occasion it is borne with less patience and greater difficulty than hunger. Sometimes inflammation of the mouth and throat and intense fever supervene. Various circumstances connected with the ordinary state of the body influence the sensation of thirst. Thus, it is greater in infancy and childhood than in adult age, and less in old age; it is greater in women than in men; it is varied by constitution and temperament; by climate; season; the nature of diet; exercise; and the passions of the mind, even by imagination.

A certain relative proportion of the fluid to the solid parts of the body is, as we have already said, essential to health; and it is only in a diseased state of habit that the balance of the proportions is broken, and either an increase or a diminution in the fluids can occur. Thus, in health, if thirst induce a person to drink freely of any bland fluid, the excretory powers of the skin and the kidneys are augmented so as to throw off the superabundance by these outlets in the form of urine and of perspiration: and even in disease, when the thirst is augmented to an inordinate degree, as in *polydypsia*, in which patients have been known to drink sixty or seventy pints of fluids in twenty-four hours, the skin and the kidneys still maintain the relative proportion between the solids and the fluids. Indeed, it is not until the body is greatly weakened, that this balance is overcome; and then, the exhalation into the cellular membrane not being reabsorbed, one kind of dropsy is produced.

It is necessary, however, so far to modify the above state-

* The defect of this sensation in these animals is supposed to depend on their having very large salivary glands, and a pancreas of greater size, in proportion to the magnitude of their bodies, than is found in animals who require drink.

ment as to admit that a temporary inequality may exist during health. When the fluids are deficient, drink is desired and taken, so that the balance is quickly restored; whilst, on the other hand, the kidneys and the skin rapidly restore the balance when the fluidity of the circulating mass is too much increased.

Taking all these considerations into account, we may define Diluents to be—" Remedies which, rendering more fluid the contents of the stomach and the bowels, and, subsequently, the general mass of the circulating fluids, lessen the morbific effects of certain matters contained either in the intestinal canal or in the blood on sensible and irritable parts with which they come in contact." We are fully aware that the idea of acrimony in the blood is problematical: but as canthariden or the active principle of Spanish flies, and some other principles, are evidently taken into the circulation, it is not improbable that other acrid matters are also received into it.

We can readily comprehend that, when the stomach and bowels are disordered by acrid matters, Diluents, taken in sufficient quantities, prevent or diminish their bad effects by increasing the proportion of the fluid contents of the bowels. And it is very possible that, in disease, the natural constituent parts of the blood may be so altered as to produce a morbid impression on the vessels containing it, and thereby increase their general force or the frequency of their action: whilst the secretions formed from it are either in a diminished quantity, or have acrid and stimulating qualities, which they do not possess in a healthy state of the body. Diluents, therefore, in this state of the blood, by augmenting, even for a short period of time, the quantity of water in the circulating mass, may render both it and the secretions more bland, and thus allay general increased excitement.

From these effects of Diluents, it will be understood that they are indicated in acrimonious states of the contents of the first passages, and in all cases of increased excitement. They are, therefore, advantageously administered in fevers, in which, besides answering the above-mentioned intentions, they remove another very considerable cause of irritation,

the sensation of thirst. They are indicated in irritable states of the duodenum and other portions of the intestines, arising from bile and diseased secretions; in dyspepsia, proceeding from causes producing a very irritable state of the coats of the stomach; in dysentery; in cholera morbus, particularly when occasioned by too great or by a hurried secretion of bile; and in diarrhœa kept up by acrid secretions from the intestines themselves.

Diluents are useful in many diseases of the urinary organs. When taken in large quantity, they cause the urine to flow abundantly, pale, and little stimulating: thus, in gravel, as it is termed, when the concreted animal acid which forms the sand-like matter collected in the pelvis of the kidney abounds, Diluents, by washing that receptacle out, assist in curing the disease. In local inflammation of the urethra, as in gonorrhœa, they are also useful, both by abating the acrimony of the urine, and carrying off the virus lodged in the urethra.

The great thirst which attends all inflammatory diseases indicates the necessity of using Diluents in these affections. There are, indeed, few diseases in which Diluents are not useful auxiliaries, by aiding the effects of other remedies—as, for example, of cathartics, emetics, diuretics, and diaphoretics.

All the substances usually employed as Diluents owe their good effects, as such, to the water they contain: water, therefore, is the only Diluent in the strict sense of the term. Several vegetable and animal infusions and decoctions are also used as Diluents: but the substances thus added to the water increase in no degree its diluent power. Some of these infusions, however, are often useful in abating nausea, and also in clearing the mouth and fauces of viscid mucus; others convey small quantities of nutriment in the most favourable form into the system. But all the advantages which can be expected from Diluents may be obtained from simple water.

Under this view of the subject, our attention should be directed to water in the different states in which it can be employed as a Diluent; the extent of its diluent powers; and its real value as a remedial agent in the treatment of diseases.

TABLE OF DILUENTS.

* SUBSTANCES OPERATING AS DILUENTS IN A NATURAL STATE.

a.—Rain Water.	*Aqua pluvia.*
Var. 1. Ice Water.	
2. Snow Water.	
b.—Spring Water.	*Aqua fontanæ.*
c.—River Water.	*Aqua fluviatilis.*

* * SUBSTANCES ARTIFICIALLY PREPARED WHICH OPERATE AS DILUENTS.

d.—Distilled Water.	*Aqua distillata.*
e.—Toast Water.	*Aqua Tosti Panis.*
f.—Barley Water.	*Decoctum Hordei.*

WATER.

The ancients regarded water as one of those bodies which they believed to be the elements of all other bodies; and the belief of its elementary nature, modified by some experiments of Van Helmont and of Mr. Boyle, which apparently demonstrated that it could be changed into all vegetable substances and into earth, prevailed until past the middle of the eighteenth century; when Macquer having fired some inflammable gas in a glass vessel, drops of a clear fluid were condensed upon the sides of the vessel, which appeared to him to be pure water. But it was not until the year 1781, that the experiments of Mr. Watts and Mr. Cavendish unequivocally demonstrated that water is a compound of hydrogen and oxygen.

Water is almost universally diffused over the surface of the globe, yet it is not found perfectly pure in any place; even

the rain and the snow that descend from the clouds, the condensation, as it were, of a natural distillation, are slightly tainted by traces of saline bodies; which circumstance can only arise from the great solvent power of water enabling it to take up a portion of such substances as it, necessarily, must come into contact with in its natural condition. In many lakes and in the ocean, the quantity of saline matter is so great as to render it unfit for diluent purposes; but, when it freezes, the saline impregnations are deposited; and ice taken up at sea affords fresh water. In the state in which water can be used as a diluent, these impregnations, although they can be detected, yet are in small quantity, and not sufficient in general either to dim its transparency, or to give it colour, or smell, or taste, and consequently to render it unfit for the ordinary purposes of life. Water which is transparent, colourless, inodorous, and tasteless, is therefore *good* and *pure* natural water. It is not necessary that water should be in this pure state for the ordinary purposes of life; but it ought not to contain so much matter in solution as to affect the nerves of the stomach more than distilled water containing the same quantity of atmospherical air which good spring water contains; nor should it contain soluble salts in sufficient quantity to stimulate the bowels to increased action. Its diluent properties, in particular, are counteracted by such impregnations.

Water fitted to answer the intention of a Diluent must be one or other of the following kinds:—

1. *Rain water*, which includes *spring* and *river water*, and *lake water*: 2. *well water*: 3. *distilled water*. Let us examine each in the order in which they are named.

a. RAIN WATER *(Aqua Pluvia)* is the purest kind of natural water. It is either an actual distillation from the water on the surface of the earth, produced by the power which air possesses of holding water in solution, in the same manner as water holds a salt in solution, and again precipitating it in drops which accumulate and increase in size as they descend; or it is produced, in the higher regions of the atmosphere, from the immediate combination of its principles by the influence of the electrical fluid. In whichever of these ways it

is formed, *Rain Water*, if collected at some distance from a town, and not at the commencement of a shower, is good water, and as free from any foreign matters as any natural water can be. In specific gravity it scarcely differs from distilled water. It, nevertheless, generally holds in solution common air, carbonic acid, carbonate of lime, and a trace of nitric acid. If it be collected from the roofs of houses, after it has rained for some time, it generally contains a little sulphate of lime. The quantity of common air in Rain Water does not exceed $3\frac{1}{2}$ cubic inches in 100 cubic inches of water; it is generally more oxygenous than atmospherical air; the same quantity of Rain Water also contains one inch of carbonic acid gas. These combinations, in the small quantities in which they exist, do not in any degree injure the diluent properties of Rain Water. It is indeed to the presence of the two elastic gases that Rain Water owes its taste, and by which it is rendered palatable to animals and useful to vegetables. Ice and snow, melted into water, being destitute of these gases, are extremely vapid. Fish will not live in water procured from ice; and it does not seem either to quench thirst or to act as so complete a solvent in the stomach as Rain Water.

To purify Rain Water and render it useful, even for the delicate purposes of chemical experiment, Morveau recommends dropping into it a little barytic water, and then exposing it for some time to the atmospheric air. This combines with the carbonic acid; and, thus destroying the solvent of the carbonate of lime, both are precipitated as insoluble salts. Perhaps, instead of exposing it to the atmosphere, it will be more useful to pour it frequently from one vessel to another; by which means not only is the minute portion of barytic water dispersed through the water and brought into contact with the carbonic acid, but it involves a great proportion of air in its substance, and improves both the taste and the utility of the fluid.

Ice and Snow Waters differ from rain water only in not containing so much air*; and, therefore, they should be ex-

* This air is, nevertheless, richer in oxygen than even that obtained from rain water: it contains 34.8 per cent. of that principle.

posed for some time to the atmosphere or poured from one vessel into another, alternately for some time before they are used as Diluents. The opinion that Snow Water causes bronchocele is erroneous.

b. SPRING WATER. *(Aqua Fontana.)*—Rain Water, when it falls on high grounds, enters the soil and filtrates through it, until it is stopped by some natural obstacle, when it pushes upwards, and, welling out upon the surface, forms *springs.* The water of the spring, aqua fontanæ, is, therefore, merely a modification of Rain Water. It is rare that the stratum is so purely siliceous or flinty, that it does not meet with some soluble matter in its passage ; and, consequently, it is less pure than distilled water. The purest spring water generally contains a little carbonate of lime and chloride of sodium, besides the usual proportions of air and carbonic acid gas. The presence of these are detected by subacetate of lead, which displays the smallest portion of carbonic acid or a carbonate, and nitrate of silver, which developes the muriates by the formation of muriate of silver.

The water of the well called St. Winifrede's, in the town of Holywell, in Flintshire, is, perhaps, the purest in this kingdom. It rises out of the crevices of a solid limestone rock ; is as transparent as crystal, pure, and well tasted ; and at one time acquired much celebrity in the cure of cutaneous affections and painful diseases of the kidneys and bladder, and in all the cases for which the Malvern springs are now celebrated. The most correct chemical analysis has detected scarcely any foreign matter in the Malvern water, and consequently the benefit which it really produces is to be attributed to its great purity augmenting its diuretic and diluent effects. In all cases it improves the appetite, increases the flow of urine, and elevates the animal spirits—effects likely to result from the improvement which the water effects on the secretions. Malvern water is resorted to chiefly by those who are labouring under scrophulous and cutaneous diseases. According to Dr. Percival's account, it has the property also of dissolving the little sabulous calculi which are often voided in nephritic affections. It is more than probable, however, that

the benefit arises altogether from the diluent properties of these waters.

Matlock, in Derbyshire, is another spring of very pure water, arising out of a compact limestone rock. All of the springs issuing from this rock possess the characters of pure water; but it is singular that all those which rise from fifteen to thirteen yards above the Derwent are tepid, whilst those both above and below this limit are cold springs. The tepid is the lowest in temperature of any thermal water in Great Britain, not exceeding 66° of Faht.: it exhales no vapour, except in very cold weather. It contains a small quantity of bicarbonate of lime when it first rises, and therefore curdles soap; but this soon disappears: and in all its other properties it resembles the best spring water.

Well Water.—This is, in fact, spring water, rising deep within the bowels of the earth, when an opening is made so as to enable the underground stream to rise towards the surface. It is characterized from spring water, which wells out spontaneously upon the surface; also, by its hardness, depending upon earthy salts, a large proportion of air, and a greater specific gravity than other spring waters. It does not break soap, as the term is; that is, instead of making with it a pure opaline solution, it curdles soap when agitated in it, owing to the lime of the calcareous salts which it contains forming an insoluble compound with the margaric and oleic acids of the soap. Although this property of Well Water renders it unfit for many operations, yet it is perfectly well adapted for the general purposes of dilution. When, however, the earthy salt is a sulphate of lime, it causes a sensation of weight in that condition of the stomach which exists in dyspepsia. The abundance of this earthy salt in the water of Paris and in the waters of many parts of Switzerland produces uncomfortable feelings to strangers who first visit these places. It is also said to produce calculous complaints in the inhabitants—a result which, however, cannot be attributed to any earthy deposite in the kidneys, but to the low solvent power of the water not being sufficient to carry off the animal acid, which concretes in the kidneys to form calculi. Well Water can be easily freed from these earthy salts: boiling

precipitates the carbonate of lime by driving off the carbonic acid which holds it in solution; and the addition of a little carbonate of soda precipitates the lime, if it really exist in the water.

If it have filtered through granite or quartz rocks, Well Water is very pure; but, in general, it contains various matters, according to the nature of the strata through which it has flowed. When the contents are in notable quantity, either to the smell or taste, it is unfit for use as a Diluent. *Hard Water* generally contains calcareous carbonates, sulphates, and muriates, besides muriate of soda; *Soft* Spring Water differs from Hard Water chiefly in containing none of the calcareous salts. Hard Spring Water, unless previously boiled, cannot be always employed as a Diluent; in weak and irritable stomachs it causes an uneasy sensation of weight at the stomach; and, when long used as daily beverage, produces a degree of dyspepsia, to which we must attribute the calculous deposites, which Dr. Percival and others have observed to be common in places where hard Water is drunk.

c. RIVER WATER. *(Aqua Fluviatilis.)*—This is merely spring water, which, from exposure to the air, has deposited much of its earthy salts, and has consequently become softer than as it welled from the spring. Mountain rills, as they generally spring from siliceous rocks, and run over stony or pebbly beds, are remarkably pure and soft. The river water in Wales, Scotland, Switzerland, and all mountainous districts, is of this description. The water of the Thames is soft, and, when filtered, is as good and fit for diluent purposes as that of the purest mountain stream.

In rivers, the exposure and the course which it runs soften the water of the springs whence it arises; and, therefore, River Water in general contains less calcareous matter than spring water, and is consequently regarded as softer. The specific gravity is less, the taste more vapid, and, when the springs which supply rivers rise from siliceous beds, River Water is, next to Rain Water, the purest in nature. The water of rivers, however, is tainted with the nature of the soil over

which their course extends; and, consequently, some which are pure and excellent at their sources lose these properties before they mingle with the sea. This is the case with the water of the Thames, which is naturally very soft and excellent; but becomes so loaded with animal and vegetable matter, from the towns and villages on its banks, that, after being kept a month or two in a closed cask, on opening it, a quantity of sulphuretted hydrogen gas, of the most offensive odour, escapes, and the water is so black and nauseous as to be unfit for use. On racking it off, however, it clears, depositing a quantity of slimy mud, and becomes remarkably clear, sweet, and palatable. In truth, the matters deposited in the Thames, the Seine, and all rivers traversing great towns, are merely mingled with the body of water, which is too large and too changing to admit of any permanent taint from solution; and consequently filtration, or the natural decomposition of the ingredients, as in the Thames water, readily fits them for every domestic and medicinal purpose.

River Water is indeed generally softer than spring water at its source, owing to the carbonic acid, contained in spring water, exhaling, as it flows in its course, exposed to the atmosphere.

Lake Water, including that of ponds, owing to the vegetation generally going on at the bottom when the sheet of water is shallow, or owing to its stagnant state when it is deep, is generally vapid; but it is soft, and, when filtered, is as good and wholesome as any other description of soft water.

* * WATER ARTIFICIALLY PURIFIED.

d. DISTILLED WATER. *(Aqua Distillata.)*—Water which contains no volatile matter, when passed through the still, is the purest state of this important fluid. It is beautifully transparent, colourless, perfectly void of taste and smell, and lighter than any other water; for even the admixture of carbonic acid and other gases in common water renders this specifically heavier than distilled water. It feels also softer to the touch when the fingers are wetted with it. Another

singular property of Distilled Water is that it produces a greater sound when poured from one vessel to another. It dissolves soap into a pure opaline mixture; and may be added to a solution of soap in spirit of wine without causing any opacity. Lime water, barytic water, solution of nitrate of silver, and oxalic acid, produce no effect on it. If kept free from the access of matters floating in the air, time produces no change on Distilled Water: it freezes exactly at 32° Faht. and boils at 212° under a pressure of the atmosphere of $29\frac{8}{10}$ inches. The purest Distilled Water is obtained from Rain Water, once distilled, rejecting the first and last products. When the water to be distilled contains carbonic acid, if the temperature be low, this gaseous fluid passes over with it; and, therefore, the first part of the product precipitates the subacetate of lead.

Distilled Water is the best solvent of all soluble animal and vegetable matter without decomposing them; on which account, could it be more easily procured, it would be the best and most wholesome beverage for common use that can be employed, and might be rendered sufficiently palatable by agitating it mechanically with the air, which it rapidly imbibes. As a medicinal agent, it not only answers every indication required from a Diluent, but washes out the pelvis of the kidneys in a manner which has led to the supposition that it is a solvent of urinary calculi.

Distilled Water is the most perfect of all Diluents, liquifying without changing the properties of both animal and vegetable substances with which it is united. It has been recommended as a solvent of concretions in the kidneys*, and in gout, scrophula, phthisis and cancerous affections†; but, although we are of opinion that in none of these diseases much confidence is to be reposed on its solvent powers, yet it cannot be denied that as a Diluent it is more likely to pervade the minutest vessels than waters containing foreign ingredients, either gaseous or solid; and, therefore, could it be easily and

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* See a paper, by Dr. Heberden, in the Medical Transactions, vol. i.

† See Dr. Lambe's Medical and Experimental Inquiry into the Origin, Symptoms, and Cure of Constitutional Diseases, &c. 8vo. 1805.

cheaply procured, it ought always to be preferred when simple dilution is required in the treatment of diseases.

e. Toast Water. *Aqua Tosti Panis.*—This form of administering water has been long in use. It is made by pouring, on a piece of well-toasted bread, water which has been boiled and allowed to cool; a small piece of lemon-peel is sometimes added. The toast communicates taste and colour to the water; but its diluent properties are not different from those of pure water.

f. Barley Water. *Decoctum Hordei.*—The decoctions of Barley, carefully prepared, according to the direction of the Pharmacopœias, are well adapted for diluting in fevers, phthisis, gonorrhœa, and many other acute diseases; and, however trifling they may appear, they contribute much to the efficacy of the treatment in these affections. Hippocrates wrote an entire book concerning their use, and that of boiled barley, in acute diseases. Besides diluting, they afford some degree of nutriment to the body; and the simple decoction, when mixed with an equal quantity of milk and a small portion of refined sugar, is a good substitute for the breast milk, when infants are unfortunately brought up with the spoon.

Use of Water as Aliment.

The use of water as an aliment may be said to be universal in organized nature. In the members of the vegetable race, every part of the support which they derive from the soil or from the atmosphere must be in a state of fluidity, before it can be taken into their system and assimilated to their substances; and as the lacteals, which may be regarded as the animal roots, cannot admit gross matters, it is evident that a considerable degree of fluidity is also necessary for the food of animals. Although the division of the substances which water liquifies is required to be less minute to enter the animal than the vegetable vessels, yet it is requisite that they also should be held in solution, or at least suspended in a fluid medium, before they can be regularly conveyed into the animal system. But water, besides performing this office, is itself an alimentary substance, without the presence of which, in a certain definite proportion to solid matter, life

could not be maintained. It is evident, therefore, that the presence of a certain quantity of fluid is essential in the process of digestion to enable the gastric juice to exert its solvent powers regularly upon the contents of the stomach; but it is also equally evident that, in a vigorous and healthy state of this organ, the presence of more water than is required to give a due solubility to the food must retard digestion. Too much will so greatly weaken the activity of the gastric fluid as to permit the food to pass into the same fermentative process which it would do were it placed in a common vessel, at the temperature of the stomach, for a given time. In the healthy stomach, this chemical action is generally overcome by the vital powers of the organ; but these languish, if the secretion which it supplies for the formation of chyme be too dilute. Hence the impropriety of the over-supply of fluid in which it is too common to indulge in at meals. It is not my intention, however, to imply that no more drink should be taken than is absolutely necessary for the moderate solution of the solid part of our food; for, were the chyle diluted only to this extent, it is probable that its rapid animalization would afford that state of over-tonicity, if we may employ such a term, to the solid fibre, which would tend to the production of inflammation and all its subsequent train of evils. On the contrary, if the spontaneous chemical changes which the food, mixed with water at a certain temperature, would undergo out of the body be permitted to occur in that organ by over-diluting the gastric juice, the consequences must be acidity, heartburn, eructations, and the whole train of symptoms that characterize dyspepsia.

In the duodenum, the bile and the pancreatic juice combine with the chyme; and here the presence of a certain quantity of fluid is as essential as in the stomach; nor is it less so during the passage of the food through the intestines; at least, until it enters the large intestines, which, from the structure of their villous coat, are evidently not naturally intended to absorb the chyle, and in which the insoluble portion of the food, becoming less and less fluid, is carried forward and ejected from the body.

It is unnecessary to trace the influence of water in carry-

ing forward the chyle through the lacteal vessels until it reaches the left subclavian vein to be mingled with the blood. But the importance of a due supply of water to the system does not terminate here: it is essential to the preservation of the proper balance between secretion and excretion—so necessary to the healthy state of the system.

The first change to which the chyle is subjected, after it is mingled with the blood, is its exposure, with the venous blood returned from every part of the body, to the action of the air in the lungs. Here the carbonaceous part, which is necessary to be thrown off, is carried out of the lungs in combination with a large portion of aqueous vapour. A similar removal of noxious or useless matters takes place in the excretion of the skin and the kidneys; and this removal, which is as necessary for preserving the health as the daily supply of food, is greatly favoured by dilution. Were it necessary to prove, by any other arguments, the utility of water as an aliment, and as favouring every salutary process connected with the support of vitality, we might mention some of the many well-authenticated cases of persons having lived on water alone, under circumstances which precluded them from obtaining any supply of solid aliment.

But, after all, the salutary or noxious influence of water as a Diluent must necessarily depend on the nature of the food, and the state of the stomach to prepare that food into proper chyme, adapted to afford healthy chyle, and to support the body. If the food be naturally watery or bland in its quality, little dilution is requisite; and vice versa. Among the lower animals, those that live upon succulent herbage require little or no drink; and the same holds good in the human subject: on the contrary, a flesh diet requires to be accompanied with more dilution, not only on account of its ready assimilation, but on account, also, of its liability to undergo changes which are in some degree noxious, and require to be obviated.

These circumstances, in a healthy state of the stomach, modify the necessity of dilution: but the powers of the stomach itself may be defective, or there may be a defect in the powers of digestion, not originating in the stomach; and in

either case the regulation of the fluid aliment of the individual becomes an object of primary importance.

No water which contains so much foreign matter as to place it within the class of mineral waters can be employed as an ordinary Diluent; and even hard or well water, as we have already stated, when daily used, proves injurious. This fact is well known to horse jockeys, who, when they are desirous to sell a horse to advantage, give him either spring water, or water which has been boiled, for drink; well knowing that the use of hard water makes his coat rough.

Remedial Use of Water.

The influence of water on the diseased body is modified by three circumstances connected with the state of the fluid—1. the caloric with which it is combined: 2. its bulk: 3. its solvent power.

1. With regard to temperature, water answers the double intention of diminishing the heat of the mouth, the fauces, the stomach, and, by sympathy, that of the whole body, and of fulfilling the purposes of Dilution. But, in admitting this, it is proper to remark, that the degree of cold which can be safely borne must be carefully ascertained. In a debilitated frame, water at a temperature under 45° is apt to prove injurious; for, when the reaction which the application of cold, whether to the surface of the body or to the stomach, should induce, is too languid, the stomach becomes oppressed, and general sinking may occur. In this case the temperature of the Diluent should be between 60° and 70°; and this fact should be borne in mind—that water at 60° merely dilutes; whereas, water under 60° and above 45° either proves tonic to the stomach or produces an injurious sensation of cold on it, which is transmitted to the general frame. One standard by which, however, the temperature of water, used as a Diluent, may be safely measured, is to be found in the degree of the animal temperature at the time, keeping in view the vigour of the frame and the character of the disease.

Looking at this part of our subject in the most general point of view, we may lay it down as an axiom, that water, to operate as a simple Diluent, is most effective the nearer it

approaches in temperature to that of the body. It is undoubtedly less grateful to the palate at this temperature than between 45° and 60°; but this is the most useful temperature. It is a common opinion, that warm water, habitually employed, has a debilitating effect on the stomach: we apprehend that this opinion is unfounded; at least, my experience leads me to regard it as a mistake. On the contrary, water between 65° and 70° improves both the appetite and the general health.

In fever, when the habit is vigorous, and the reaction of the stomach strong, as low a temperature as fluid water can admit of may be employed. The immediate effect upon the stomach will be rapidly communicated to the skin, and the same result be obtained as if the whole body had been immersed in the fluid; the pungent heat will be diminished, and a copious perspiration follow; at least, such is the general result. The period of the febrile paroxysm must also be taken into account; for if water at this temperatue be drunk in the cold stage, it augments the sensation of cold at the surface, oppresses the præcordia, and renders the pulse feeble, and at the same time more frequent: if given during the flow of perspiration, it may check this salutary excretion; and, in either case, the patient must suffer. The Diluent, in the different stages of a fever, should be first of a temperature above 70° when the rigors are present; then cold, as the hot stage develops itself; and lastly, tepid, when the perspiration flows freely.

Independent of the effect of water in fever, it is essential to attend to its temperature when it is used as a general Diluent. Those who have irritable stomachs cannot bear a draught of very cold water with impunity; and a temperature approaching to 70° is demanded. In the dyspeptic, there is frequently a distressing and gnawing pain, arising from the acrimony of the undigested food, combined with heartburn. Nothing relieves this state so suddenly as a draught of water, taken as hot as it can be drunk.

2. With respect to the influence which the *bulk* of the liquid exerts in modifying its diluent effect, we may merely observe, that although much of the benefit to be derived from the di-

luting properties of water depends on the regulation of the quantity thrown into the system, yet there is no standard by which this can be easily determined. Much depends on the state of the excretory organs at the time—those, for example, of the skin, the lungs, and of the kidneys. But, under every condition of these organs, a large quantity of water, taken into the stomach, oppresses from its bulk, in the same manner as any other distending cause. It is possible, also, that the arterial system may be overloaded, not so much from the bulk of the water taken as from a diminished action of the cutaneous exhalants and other excretories. Much water, in this condition of the system, if taken into the stomach, may cause tension and fulness; and is not unlikely to produce a sudden determination to the head, which, in languid habits, may cause apoplexy—a disease not unfrequent in the worn-out invalids who resort to watering places and incautiously take large draughts of water, and this sometimes when there is no fever present.

3. But the most important circumstance modifying the influence of *Water* as a *Diluent* is the degree of *solvent* power which it exerts. This necessarily will depend much upon the temperature and the nature of the contents of the stomach which it is intended to act upon. If these be of easy solution, we must enquire how far they will operate, more forcibly or otherwise, in this state, and be regulated by the result, in fixing the extent of dilution. Thus, if a poison be taken into the stomach, which requires to be in a state of complete liquidity before it can operate, it would be dangerous to throw in water or any other fluid until the greater part of the offending substance be removed, either by vomiting or by other means; but this being accomplished, then the most ample dilution will so weaken what remains as to render it inert, and aid greatly in carrying it out of the body.

Such are the general effects of water as a diluent on the animal system, both in the state of health and that of disease: it now remains only to examine its practical utility as a remedy.

If we look into the history of our profession, we shall find that water was the chief remedy employed by Hippocrates in the

treatment of fever; sometimes in its pure state, sometimes mixed with vinegar. He varied the temperature of the fluid according to the seasons of the year; in winter, recommending it to be used in a tepid state, in summer, as cold as it could be procured. Galen concurred in this excellent practice; but with some, not injudicious, restrictions respecting the quantity, the state of the patient, and the period of the disease. Among the ancients, however, the use of water, even in fevers, was condemned; particularly by Asclepiades: even the judicious Celsus concurs in the propriety of his practice. Among the moderns, Stahl (whose theory was useful, in as much as it led men back to Nature) first introduced the liberal use of water in fevers. Hoffman, who followed Stahl in many things, restricts the use of water in these diseases; yet he was a great supporter of the efficacy of water as a remedy, and wrote a work expressly to prove its value.

In Spain, where medicine has not arrived at the same degree of perfection as in this country, cold water is still, as it has long been, the principal remedy in fever; and, in what is termed the *dieta aquæa*, from five to ten pints are ordered to be taken daily. But this is nothing to the extent to which this diet was formerly carried; and which was the occasion of the well-known satire of Le Sage, in the excellent novel of Gil Blas, in which this part of the practice of the Spanish physicians is very happily ridiculed in the person of Doctor Sangrado.

In England, water was little used in fevers until the commencement of the eighteenth century, when it was introduced by Dr. Smith, an able physician, and Dr. Hancock, the author of "*Febrifugum Magnum*," a Doctor of Divinity, Rector of St. Margaret's, Lothbury. Those innovators carried some of their particular opinions, especially those respecting the use of water as a febrifuge, to an extravagant length, and brought discredit upon the practice. In the present day, a more intermediate course is taken; the advantage of dilution in fevers is well understood and appreciated; and, at the same time, the limits to which it may be carried are as well known. A physician does not now order water in quantities sufficient to injure as greatly by its bulk as it is calcu-

lated to benefit by its diluent properties; but he leaves the quantity to be regulated, in a degree, by the desires of the patient. This is undoubtedly the best guide; and it has been remarked by every writer on diseases, that, in acute fevers, the desire for watery fluids is so striking as to be almost a measure of the degree of fever which rages. As simple water contains nothing in itself noxious, the attention of the physician is required to be directed only to quantity and temperature. And, with regard to both these circumstances, we have already expressed our opinion: the measure of both may, in truth, be left to the desires of the patient.

In the phlegmasiæ, particularly in those instances in which the part affected is extensive, as in the inflammation of the serous membrane lining the cavity of the thorax, and in similar cases, mild and diluent drinks ought to be plentifully administered. Whether these consist of water only, or of vegetable infusions or decoctions, they should never be given cold, but moderately tepid, and in small successive portions, frequently repeated.

Of all the phlegmasiæ, that one which most demands the use of Diluents is nephritis. The excretory power of the kidneys is much diminished by inflammation in the organ; and the nature of the part affected has generally been regarded as requiring that the Diluents should be of a mucilaginous kind; but tepid water answers every intention, and it may be more freely administered than is admissible in any of the other phlegmasiæ.

In the eruptive fevers, comprehending small-pox, chicken-pox, measles, scarlet fever, nettle-rash, and similar affections, Diluents, and particularly water, may be used ad libitum.

In that form of small-pox in which the pustules are distinct, cold water may be freely administered during the whole period of the eruptive fever; in the confluent, it ought to be tepid. In measles, also, the Diluents should be tepid; but in scarlet fever, as all catarrhal symptoms are absent, and the most distressing circumstance is the burning heat both of the skin and the viscera, the coldest water which can be procured should be administered. It answers nearly the same purpose as the cold affusion, or cold water applied to the surface

during the period of excitement. In both cases, the heat is rapidly diminished, the skin becomes soft, and, the general irritability of the system being lessened, sleep is induced; and often the most alarming cases are converted into the most moderate and manageable.

In catarrh, the acrimony of the secretion of the mucous membrane led to the supposition that mucilaginous drinks were requisite; but experience has proved that water is capable of answering every purpose for which dilution can be required in this disease. It is almost unnecessary to say that, whatever fluid is taken, it ought to be in a tepid state.

In no disease is copious dilution so requisite as in bilious cholera. Indeed, the chief indication in the commencement of this disease is the evacuation of the redundant bile upon which both the vomiting and purging characterizing the attack depend. No medicines are required, nor would any be effectual, until the bile is, as it were, fairly washed out: tepid water accomplishes this better than any other Diluent. The same may be affirmed respecting bilious diarrhœa.

APPENDIX.

I. TABLE OF EQUIVALENTS OR ATOMIC WEIGHTS* OF CHEMICAL SUBSTANCES BELONGING TO THE MATERIA MEDICA†.

C stands for Carbon; H, Hydrogen; N, Nitrogen; O, Oxygen; Chl. Chlorine; S, Sulphur; P, Phosphorus; W, Water, A, Ammonia; Ba. Barium; L, Lead; M, Mercury; Z, Zinc; C̈, Carbonic Acid; Ir. Iron; Io. Iodine.

Acid Acetic, 4 C + 3 H + 3 O	51
Arsenious, 1 A + $2\frac{1}{2}$ O	57.7
Benzoic, 15 C + 6 H + 3 O	120
Boracic, 1 B + 2 O	24
Crys. 2 Water (2×9)	42
Citric, 4 C + 2 H + 4 O.	58
Crys. 2 Water (2×9)	76
Hydrocyanic, 1 H + 2 C, 1 N	27
Kinic, $15\frac{1}{2}$ C + 12 H + 12 O	201
Muriatic, 1 H + 1 Chl.	36.45
Nitric, 1 N + 5 O	54
Liquid, 2 water (gr. 1.5)	72
Oxalic, 2 C + 3 O + 3 W	63
Phosphoric, 1 P + $2\frac{1}{2}$ O.	35.7
Succinic, 4 C + 2 H + 3 O	50
Sulphuric, 1 S + 3 O + 1 W (gr. 1.8485)	49
Tartaric, 4 C + 2 H + 5 O + 1 W	75
Acetate of Ammonia, 1 A + 1 Acid + 7 W	131
Baryta, 1 Ba. + 1 Ac. + 3 W	154.7
Copper (Neutral) 1 Cop. + 1 Acid + 1 W	99.6
—(Diacetate) 2 Cop. + 1 Acid + 6 W	184.2
—(Triacetate) 3 Cop. + 1 Acid + $1\frac{1}{2}$ W	183.3
Lead (Neutral) 1 L + 1 Acid + 3 W	189.5
—(Diacetate) 2 L + 1 Acid	274
—(Triacetate) 3 Pl. + Acid	385.5
Mercury, 1 M + 1 Acid	259
Potassa, 1 Pot. + 1 ac.	98.15
Zinc, 1 Z. + 1 ac. + 7 W	154.5
Alcohol, 3 H + 2 C + 1 O	23
Alumina, 1 Al. + $1\frac{1}{2}$ O	25.7
Aluminum	13.7
Ammonia, 3 H + 1 N	17
Amygdaline, 19 C + 28 H + 1 N +	70.192
Antimony	64.6
Oxide of, 1 An. + $1\frac{1}{2}$ O	76.6
Sesquichloride, 1 An. + $1\frac{1}{2}$ Chl.	100.05
Sulphuret, 1 An. + $1\frac{1}{2}$ Sul.	88.6
Persulphuret, 1 An. + $2\frac{1}{2}$ Sul.	104.6
Bisulphuret, An. + 2 Sul.	96.6
Oxy. Sulph. (Glass) 1 Ox. of Ant. + 2 An. + 3 Sul.	252.72
Arsenic	37.7
Sulphuret, 1 Ar. + 1 Sul.	53.7
Arsenite of Potassa.	104.22
Barium	68.7
Oxide of (Baryta) 1 Ba. + 1 O	76.7
Chloride, 1 Ba. + 1 Chl.	104.15
Sulphuret, 1 Ba. + 1 Sul.	84.7
Bismuth	71
Oxide of, 1 Bi. + 1 O.	79
Bisulphate of Potassa, 2 Sul. acid + 1 Potassa + 2 W	282.18
Boron	8
Brucia, 33 C + 18 H + $1\frac{1}{2}$ N + 6 O	278
Caffein, 8 C + 5 H + 2 N + 2 O	97
Calcium	20.5
Chloride of, 1 Cal. + 1 Chl.	55.95
Oxide (lime) 1 Cal. + 1 O	28.5
Camphor, 2 C + 3 H + 1 O	23
Carbon	6
Carbonate of Ammonia, 1 Am. + 1 C̈	39
Sesquicarb. 1 Am. + $1\frac{1}{2}$ C + 5 W	59
Baryta, 1 Ba. + 1 C̈.	98.7
Carbonate of Iron, 1 Ox. Ir. + 1 C̈	58

* In this Table Hydrogen is taken as unity.

† The chemical equivalents in the body of the work are those which were received as correct until lately; the present Table contains those now adopted.

Carbonate of Lead, 1 Ox. L. + 1 C̈ 133.6
Magnesia, 1 Mg. + 1 C̈ 42.7
Potassa, 1 Pot. + 1 C̈ 69.15
Bicarbonate, 1 Pot. + 2 C̈ + 1 W....... 100.15
Carbonate of Soda, 1 So. + 1 C̈ + 10 W 143.3
Bicarbonate, 1 So. + 2 C̈ + 1 W.. 84.3
Chlorine 35.45
Chlorate of Potassa, 1 Po. + 1 C̈hl. 122.6
Cinchonia, 21 C + 11 H + 1 N + 1 O 159
Copper 31.6
Oxide, 1 Cop. + 1 Ox. 39.6
Cyanogen, 2 C + 1 N........ 26
Delphina, 26 C + 3 + H + 1 N + $3\frac{1}{2}$ O 236
Ether, 2 C + 3 H + 1 O 37
— Nitric, 4 C + 5 H + 1 N + 4 O 75
Hydrate of Lime, 1 L + 1 W.. 37.5
Hydrogen 1
Sulphuretted, 1 H + 1 Sul.............. 17
Iodine 126
Iodate of Potassa, 1 Pot. + 1 Io. 291.15
Iron 28
Chloride, 1 Ir. + 1 Chl. .. 63.45
Perchloride, 1 Ir. + $1\frac{1}{2}$ Chl. 80 7
Oxide, 1 Ir. + 1 O....... 36
Peroxide, 1 Ir. + $1\frac{1}{2}$ O ... 40
Sulphuret, 1 Ir. + 1 Sul... 44
Lead 103.5
Iodide, 1 L + 1 Io....... 229.5
Oxide, 1 L + 1 Ox...... 111.5
Magnesium 12.7
Oxide of (Magnesia) 1 Mg + 1 O..... 20.7
Manganese 27.7
Binoxide, 1 Man. + 2 O 39.7
Mercury 200
Bicyanide, 1 M + 2 Cy 252
Chloride, 1 M + 1 Chl. 235.45
Bichloride, 1 M + 2 Chl. 270 9
Iodide, 1 M + 1 Io... 326
Biniodide, 1 M + 2 Io. 452
Oxide, 1 M + 1 O 208
Binoxide, 1 M + 2 O .. 216
Sulphuret, 1 M + 1 Sul. 216
Meconine, 9 C + 9 H + 4 O . 95
Mercury, Bisulph. 1 M + 2 Sul. 232
Muriate of Ammonia, 1 Am. + 1 Acid........... 53.45
Muriate of Baryta, 1 Ba. + 1 Acid 113.15
Lime, 1 Cal. + 1 Acid + 6 W.......... 118.95
Morphia, 35 C + 18 H + 1 N + 60 290
Nitrogen 14
Nitrate of Baryta, 1 Ba. + 1 Acid 130.7
Potassa, 1 Pot. + 1 N acid 101.15
Silver, 1 Oxide + 1 Acid 170
Oxygen 8
Phosphorus 15.7
Phosphate of Soda, 1 So. + 1 ac. + $12\frac{1}{2}$ W 179.5
Potassium 39.15
Oxide (Potassa) 1 Pot. + 1 O 47.15
Sulphuret, 1 Pot. + 1 Sul............ 55.15
Quinia, 21 C + 11 H + 1 N + 1 O............... 159
Salicina, 2 C + 2 H + 1 O ... 22
Silver...................... 108
Sodium 23.3
Oxide (Soda) 1 So. + 1 O 31.3
Solània, 28 C + 42 H + 1 N + $3\frac{1}{2}$ 252
Sulphate of Copper, 1 Ox. Cop. + 1 S acid 5 W .. 124.6
Iron, 1 Ox. Ir. + 1 S acid + 6 W . .. 130
Magnesia, 1 Mg. + 1 S acid 7 W 123.7
Bisulph. Mercury, 1 Ox. M. 2 S acid .. 296
Potassa, 1 Pot. + 1 Sul. acid 87.15
Soda, 1 Sod. + 1 Sul. acid........ 71.3
Zinc, 1 OZ, 1 S acid 7 W 143.5
Alumina and Potassa (Alum)......... 474.55
Sulphuretted Hydrogen 17
Tin........................ 57.9
Tartarized Soda, 1 Tart. Pot. + 1 Tart. So. + 8 W 282.18
Tartrate of Potassa, 1 Pot. + 1 acid 131.15
Bitartrate.......... 183.15
Antimony & Potassa 350.17
Veratria, 44 C + 60 H + 3 N + 10 O 446
Water, 1 H + 1 O 9
Zinc 32.6
Oxide of, 1 Z + O 40.5

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a stands for volume first, b for volume second.

FINIS.

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CORRIGENDA.

Vol. i. p. 45, l. 13 from bottom, *for* in *read* into.
——— p. 48, l. 3, *for* ascescent *read* acescent.
——— p. 128, l. 11 from bottom, *dele* of.
——— p. 132, l. 5, *dele* Cyanuret of Mercury.
——— p. 151, l. 1, bottom, *for* 68° *read* 680°.
——— p. 103, l. 16, *for* ARISTOLCHIÆ *read* ARISTOLOCHIÆ.
——— p. 245, l. 26, *for* Caventau *read* Caventou.
——— p. 361, l. 23, *for* Oxide of Mercury *read* Mercury of the Oxide.
——— p. 416, l. 9, 10, from bottom, *transpose* the marks † and ‡.
——— p. 431, *transfer* the sentence beginning "Thence chlorine," l. 12, to p. 432, l. 3.
——— p. 487, l. 12, *for* Nirtrate *read* Nitrate.
——— p. 521, l. 24, *transfer* the words "or a salt of Baryta" to l. 25, after the word "ammonia."
——— p. 640, l. 17, *for* chrystalline *read* crystalline.
——— p. 612, l. 7, *for* adipocine *read* adipocire.
——— p. 660, l. 13 from bottom, *for* substances *read* instances.
——— p. 689, l. 16 from bottom, *for* $1\frac{1}{2}$ *read* $2\frac{1}{2}$
——— ——— l. 15 ——— *for* $(8 \times 2) = 12$ *read* $(16 + 4) = 20$; and *for* 50 *read* 58.

Vol. ii. p. 29, l. 22, *for* Petallæ *read* Petala.
——— p. 67, l. 19. *for* collequative *read* colliquative.
——— p. 181, l. 8 from bottom, *for* anticipating *read* repeating; l. 6, *for* to say *read* said; l. 5, *for* attempt *read* introduce.
——— p. 209, l. 16, for *Ipecacuanha* read *Ipecacuanhæ*.
——— p. 224, l. 22, *for* octohedrous *read* octohedrons.
——— p. 225, l. 7, *after* or *add* acidulated; l. 12, for + 3 *read* + 2; l. 14, *for* 350.17 *read* 350.35.
——— p. 236, l. 3 from bottom, *after* gastric *add* causes.
——— p. 238, l. 12, *after* Donald *add* ,
——— p. 245, l. 20, for *conniventis* read *conniventes;* last line, *for* inwards *read* onwards.
——— p. 249, l. 2, *for* abdomen *read* duodenum.
——— p. 255, l. 26 and 27, *for* narcotics *read* catharthics.
——— p. 285, l. 7, *for* opapue *read* opaque.
——— p. 319, l. 25, for *Sodæ* read *Soda*.
——— p. 321, l. 25, for *Potassa* read *Potassæ*.
——— p. 399, l. 12, *for* BARYTA *read* BARYTÆ.
——— p. 334, note, *for* Cheledonium *read* Cheledonium.
——— p. 407, l. 8, *for* CUBEBA *read* CUBEBÆ.
——— p. 417, l. 1, bottom, *for* UMBELLATA *read* UMBELLATÆ.

To table of equivalents add Sulphur 16.

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